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# Rebuilding Theories of Technology Acceptance: A Qualitative Case Study of Physicians' Acceptance of Technology

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# REBUILDING THEORIES OF TECHNOLOGY ACCEPTANCE: A QUALITATIVE CASE STUDY OF PHYSICIANS' ACCEPTANCE OF TECHNOLOGY

A Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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# Abstract

**REBUILDING THEORIES OF TECHNOLOGY ACCEPTANCE: A QUALITATIVE CASE STUDY OF PHYSICIANS' ACCEPTANCE OF TECHNOLOGY**

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The Technology Acceptance Model has been widely applied and has been quite successful at explaining the *behavioral intention to use* technology in many organizations. One of the most significant variables in the Technology Acceptance Model is *perceived ease of use.* The Technology Acceptance Model purports that *perceived ease of use* contributes to the *behavioral intention to use* technology. Additionally, the model purports that *perceived ease of use* is an antecedent of *perceived usefulness.* In the adoption and use of technology by physicians, previous studies show that the Technology Acceptance Model predictions have been incorrect. Specifically, the aforementioned

*perceived ease of use* prediction is not repeatedly supported in health care environments. In order to further investigate and ultimately explain this abnormality in the Technology Acceptance Model's predictive ability in the health care industry, a positivist case study using various coding techniques was conducted to investigate physicians' behavioral intention to use a Personal Digital Assistant in their work environment. The Physicians' Technology Acceptance Model is a major result of this case study. The Physicians' Technology Acceptance Model, which is based on the Extended Technology Acceptance Model (Venkatesh et al. 2000), is absent of the perceived ease of use construct and includes two additional constructs: perceived substitution, which is defined as, "the degree to which an individual perceives that alternate sources are available to deliver the same information or assistance as the technology in question" and facilitating conditions (Venkatesh et al. 2003) , which is defined as, "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (p. 453). This organizational case study rigorously follows a positivist approach ("natural-science model" of social-science research (Lee 1989b)).

# CHAPTER 1
# INTRODUCTION

Information technology acceptance and adoption have received an enormous amount of attention over the past twenty years. This organizational case study investigates physicians' intention to use technology in health care organizations and will rigorously follow the *natural-science model*. Lee (1991) states the following about the positivist approach, also known as the natural-science model:

> ...the positivist approach involves the manipulation of theoretical propositions using *the rules of formal logic* and *the rules of hypothetico-deductive logic,* so that the theoretical propositions satisfy the *four requirements* of falsifiability, logical consistency, relative explanatory power, and survival. (pp 343-344)

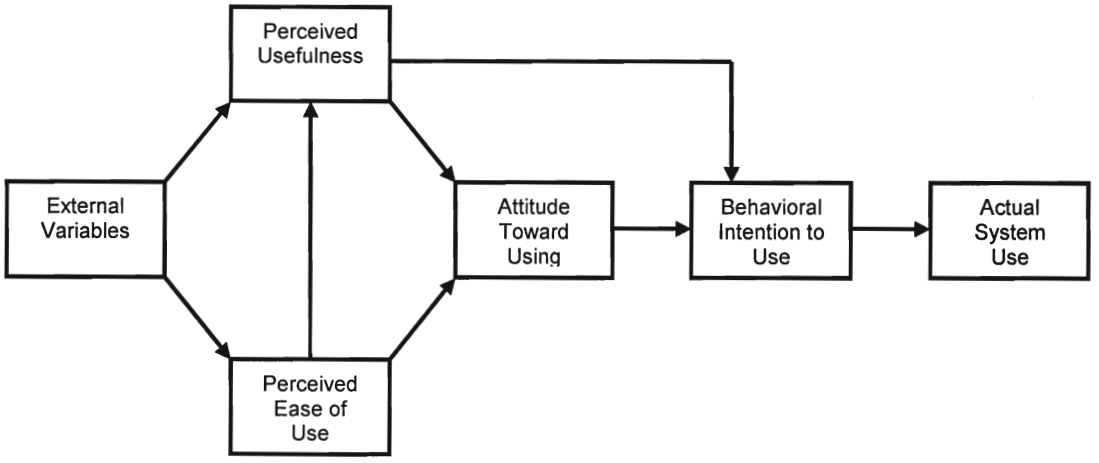


**Figure 1 - Technology Acceptance Model**

Lee (1991, pp. 346-347) defines the requirements as: (1) falsifiability: there is a possibility that the theory can be proven untrue, (2) logical consistency: the predictions that the theory produces do not contradict one another, (3) relative predictive power: stands equal to or surpasses other known competing theories, and (4) survival: all attempts to show a theory falsifiable have failed.

The Technology Acceptance Model (TAM) (Davis 1986; Davis 1989; Davis et al. 1989) is a very well known model in the information systems field. TAM purports to explain and predict system-usage[1] behavior and is shown in Figure 1. Subsequent to TAM, Venkatesh and Davis (2000) developed the Extended TAM by including social influences and cognitive instrumental processes to the original TAM. The Extended TAM is shown in Figure 2.

Previous research (e.g., Bajaj et al. 1998; Chismar et al. 2002; Chismar et al. 2003; Hu et al. 1999a; Jackson et al. 1997; Keil et al. 1995; Lucas et al. 1999; Subramanian 1994; Szajna 1996; Taylor et al. 1995a; Taylor et al. 1995b; Wiley-Patton 2002) reveal that TAM and the Extended TAM, both purporting to predict users intention to adopt technology, have not done so.

Figure 3 on page 34 is a more recent technology acceptance model known as the *Unified Theory of Acceptance and Use of Technology* (UTAUT). This model was presented by Venkatesh, Morris, Davis, and Davis (2003) and empirically validated. To date only a few studies have applied and/or validated UTAUT.

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[1] The terms "usage" and "the behavioral intention to use" are synonymous in this case study. The author is aware that actual usage cannot be predicted.

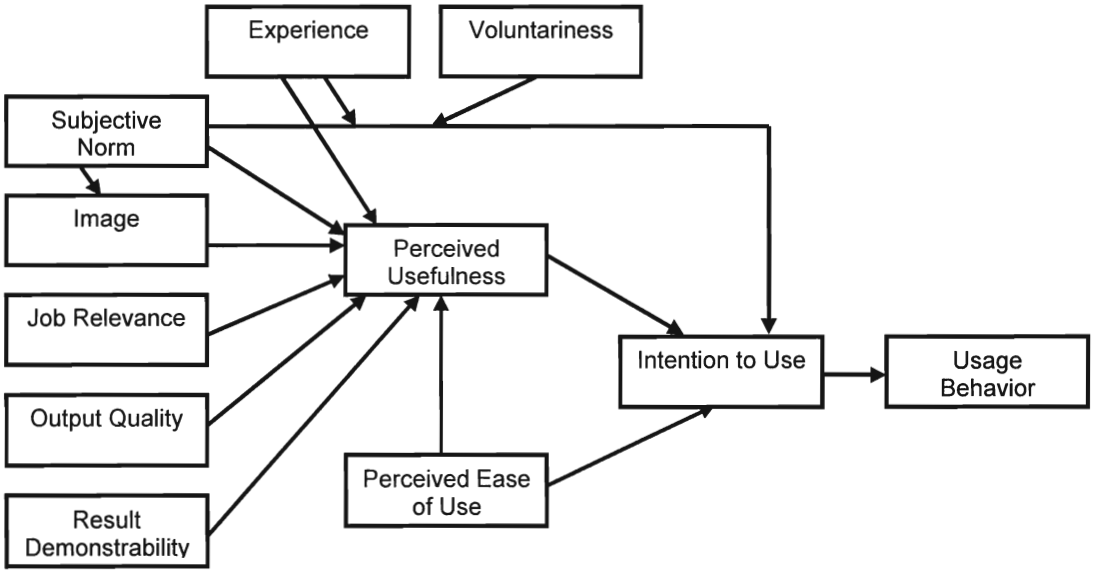



**Figure 2 - Extended Technology Acceptance Model**

Many studies that have applied TAM and its variants fully support the expectations that are predicted by the models. However, Legris, Ingham, and Collerette (2003) offer a critical review of TAM and the Extended TAM and show nine studies that have either a non-significant or significant reverse relationship of what TAM or the Extended TAM predicts. These inconsistencies occur in several industries, including health care.

The use of information technology has become pervasive across every industry including health care. With the increased use of the internet in the 1990s and in the new millennium, the speed of communication and the standardization of information have drastically increased. These phenomena allow physicians to deliver better quality care to their patients. For instance, using technology such as telemedicine, physicians can conduct electronic house calls to monitor, direct, and diagnose patients without being

physically present. Telemedicine allows physicians to deliver health care services to many persons without a concern of physical locality.

Medical informatics is the field that deals with the information processing, communication, and cognitive tasks of medical research, education, and practice. This includes the information science and the technology to support these tasks. Most health care institutions are committing to information systems and services, which affect every aspect of the organization's function (Greenes et al. 1990). It is important that physicians are not only aware of health care technology, but also its use, to provide excellent or superior quality care. Unfortunately, the adoption and use of technology by physicians is lacking (Wiley-Patton 2002).

Physicians face many challenges and obstacles once they decide to embrace the use of technology. Most recently, the introduction of the Health Insurance Portability and Accountability Act of 1996 (HIPAA) has made this transition to using technology more difficult. HIPAA has had a major impact on health care providers and their partners with whom they electronically conduct business. There are four parts of HIPAA and each section stipulates how health care providers and their business partners are to handle patient information. HIPAA specifications cover (1) electronic transactions and code sets, (2) security, (3) unique identifiers, and (4) privacy. The Act does not require that one conduct business electronically; however, if one does, specific requirements must be followed. One stipulation is that the health care provider is responsible for ensuring that their business partners also comply with the Act's specifications. This fact significantly impacts a physician's adoption of technology.

Another major challenge of a physician's adoption of technology is the behavioral changes needed by physicians, other health care providers, administrators, and patients. Clearly, the weakest link syndrome applies in technology acceptance. This means a physician cannot send patient instructions electronically if the patient does not have a personal computer, an email address, or the ability to instant message.

Benefits to using technology outweigh many of these challenges in the health care industry. One beneficial technology is e-prescribing -- the writing, checking, and delivery of prescriptions electronically (Anderson et al. 1999). The Institute of Medicine (1999) estimated that between 44,000 and 98,000 Americans die from medical mistakes every year. Seven thousand of these individuals die as a result of medication errors. A physician instituting such simple technologies as a digital pen when writing a patient's prescription or a Personal Digital Assistant (PDA) to check off the medication specifics to be downloaded into a central database of patient information, could assist in reducing medication errors that occur due to poor penmanship (Clark 2005).

To ensure that there is a continued increase in physicians delivering quality health care, it is important to investigate the phenomena of physicians' behavioral intention to use information technology. This research of physicians' technology adoption is vital because acceptance of computer systems and technological advancements historically assist health care providers in delivering high quality care (Kuziemsky et al. 2005, p. 205). Therefore, the motivation behind this study is to understand the conditions and the situations that must exist in order for physicians to increase their use of technology.

## 1.1. Information Technology and Health Care

Categorically, health care information systems are normally classified as clinical, administrative, or special purpose. Clinical systems support patient care. Patient monitors, electronic prosthetics, and computer-assisted surgery are clinical systems. Administrative applications include the Electronic Medical Records (EMR) system. Also included in this category are separate and consolidated software applications that assist activities such as billing, scheduling, maintaining data, accounting, and communicating with other computer systems. MediSoft, AdvancedMD, and 2KMedical's Lytec are specific software applications that are administrative systems. All other medical systems are special purpose. These special purpose medical systems include simulation software used in the training and development of health care professionals, research databases, self-help software, and scanning tools such as those used in an MRI (Magnetic Resonance Imaging) (Wiley-Patton 2002).

## 1.2. Research Goal and Questions

As stated, TAM and the Extended TAM have not reliably predicted physicians' behavioral intention to use technology. In this research, an improved model is presented that more accurately explains doctors' technology usage. This improved model is developed by specifically investigating the relationship between perceived ease of use and perceived usefulness using a Personal Digital Assistant (PDA) as the technology instantiation. The goal of this research is to present an improved technology acceptance

theory that better explains the determinants of physicians' behavioral intention to use technology.

Accordingly, the following research questions guide this study:

1) What is it about physicians and their environments that cause TAM's prediction that *perceived ease of use* influences *perceived usefulness* to be incorrect?
2) What, if any, characteristics of physicians and their environments contribute to physicians' use and non-use of PDAs?

### 1.3. Significance of the Research

Information technology applications are abundantly present in the health care industry. However, while physicians indicate that information technology in health care is not only desired but needed (HIMSS Survey 2005), the use of information technology among physicians is still lacking (Wiley-Patton 2002). The HIMSS survey (2005) indicates that increasing patient's safety by reducing medical errors is the most important health care issue today, and the top business issue that will affect health care in the future. The most important future technology, as stated by the survey respondents, is implementing an EMR system. To date, only 18 percent of the survey respondents currently use an EMR system.

Even with a lack of technology acceptance and use in health care, overall technology acceptance is heavily researched. The Web of Knowledge (which includes the Social Science Citation Index (SSCI)) reports that Davis' technology acceptance articles

have been referenced over 1200 times since 1989. This number does not include the multitude of studies that use TAM as a basis and extend, refute, or verify the model. Additionally, researchers have investigated and empirically tested technology acceptance models in various ways which encompass different industries, different cultures, and different applications (e.g., Al-Gahtani 2001; Amoako-Gyampah et al. 2004; Hu et al. 1999a; Hu et al. 2002; Hu et al. 1999b) in attempts to corroborate the models' predictive ability. In most of these studies, technology acceptance models sufficiently predicts an end-user's behavioral intention to use a technology. However, as stated, the predictive ability of technology acceptance in the health care industry has been much less successful.

There are several non-empirically-tested suggestions for this lack of conformity to TAM's predictive ability in a health care environment. These are considered alternative theories. Hu et al. (1999a) suggest that perceived ease of use is not a determinant of perceived usefulness, because physicians on the average have a higher level of intellectual and cognitive capacity, competence, adaptability to new technologies, and reliable access to assistance in operating technology. Another proposal presented by Chau and Hu (2002b) is that physicians tend to be more pragmatic in their acceptance of technology. They say that physicians, unlike non-professionals, prefer to focus on the usefulness of the technology (e.g., will it help my patients, will it provide a better diagnosis) than on its ease of use. These suggestions have not been researched further.

This study builds on the current theories of technology acceptance by studying physicians and their environments and explaining physicians' behavioral intention to use

technology. This investigation presents a new model that offers greater predictive power than the current technology acceptance theories. The resultant theory from this case study approach provides complementary explanations to those provided by theories that have resulted from the more widely used quantitative research methods. This study gives several possible reasons why a model that has explained up to 69 percent of the variance in many industries has repeatedly failed to predict the acceptance of technology in heath care environments.

Given that the use of technology is such an important ingredient in increasing patient safety, it is imperative that there be more accurate ways of predicting the use and non-use of technology in health care. The current theories such as TAM and the Extended TAM have repeatedly failed. Therefore, this research is significant because an improved model is presented that is a better predictor of physicians' behavioral intention to use a technology instantiation – specifically a PDA.

### 1.4. Guide to this Dissertation

In order to assist the reader in deciphering the acronyms and abbreviations that are used in this dissertation, the definitions are presented in Table 1. The majority of the acronyms used in this case study report are those that are used primarily in health care and technology acceptance literature.

Chapter 2 contains an overview of literature that provides a solid foundation for this research. Section 2.1 is a review of the behavioral psychology adoption literature. The models that are discussed in this section are the adoption models whose constructs

**Table 1 – Major Acronyms/Abbreviations Used in this Study**

| | |
|---|---|
| CIT | *Critical Incident Technique* |
| DTPB | *Decomposed Theory of Planned Behavior* |
| EMR | *Electronic Medical Records* |
| GFI | *Goodness of Fit* |
| HIMSS | *Healthcare Information and Management Systems Society* |
| HIPAA | *Health Insurance Portability and Accountability Act of 1996* |
| ITAM | *Information Technology Adoption Model* |
| MRI | *Magnetic Resonance Imaging* |
| NUD*IST | *Non-numeric Unstructured Data Indexing, Searching and Theorizing* |
| PDA | *Personal Digital Assistant* |
| PDR | *Physician's Desk Reference* |
| PTAM | *Physicians' Technology Acceptance Model* |
| TAM | *Technology Acceptance Model* |
| UTAUT | *Unified Theory of Acceptance and Use of Technology* |
| VCU | *Virginia Commonwealth University* |

were considered in the development of UTAUT. Also resident in the literature review (chapter 2) is a review of several technology acceptance and PDA health care articles. Lastly, this chapter presents a review of literature where acceptance models have failed to predict usage.

The methodology used in conducting this research is presented in Chapter 3. Section 3.1 is an overview of the research model used in conducting this research. The

model includes the use of hypothetico-deductive logic to carry out this empirical research in a non-laboratory setting (Lee 1989a; Lee 1989b; Lee 1991), the Yin (1994) case study research method to appropriately guide this study and produce quality work, and coding techniques to assist in preparing data for analysis. Section 3.2 is a description of the research design where a discussion of particulars such as designing the case study, data collection, data analysis, and a display of the activities that took place to ensure the quality of this case study (Yin 1994).

In Chapter 4 the approach to the data analysis and the results of this analysis is presented. First is a description of the documentation of this case study, which is inclusive of the case study database, protocol, and interview manuscripts. Subsequently the coding process is described, and the resultant categories and propositions are presented. Also in Chapter 4 are examples of how coding was conducted.

Chapter 5 is a synthesis of the findings from this research. The Physicians' Technology Acceptance Model (PTAM) is introduced along with a discussion of the model's predicting capabilities. Also presented in this chapter is a discussion on why PTAM is better than other technology acceptance models in predicting physicians' behavioral intention to use technology. PTAM's more accurate predicting ability will be corroborated by applying the model to previous research situations where the results of the studies were contradictory to TAM's or the Extended TAM's predictions. Chapter 5 is concluded with a presentation of how validity criteria as given by Yin (1994) and Lee (1989b), and an additional criterion referred to as comparative validity, exist in PTAM.

# CHAPTER 2
# LITERATURE REVIEW

Within the social science research community, the definition of technology varies. Goodhue and Thompson (1995, p. 216) indicate that some organizational researchers (e.g., Perrow (1967), Fry and Slocum (1984)) define technology quite broadly as "actions used to transform inputs into outputs." Davis (1986), on the other hand, presents technology more precisely, and identifies a specific computer application, CHART-MASTER$_{tm}$, for the IBM Personal Computer, as the technology used to test his proposed TAM. The ease of use and usefulness instruments used by Davis (p. 265) are shown in Appendix B on page 164. Davis describes CHART-MASTER$_{tm}$ as:

> ...a graphics software package for the IBM Personal Computer designed by Decision Resources, Inc. of Westport, Connecticut. CHART-MASTER$_{tm}$ is intended for displaying numerical information in graphs such as bar charts, line charts and pie charts.

Therefore, given these often diverse views, it is important to understand how researchers and physicians define information technology. These two groups of individuals may view information technology the same. However, if there is a difference in how they view technology, then predicting the acceptance of information technology

using models such as TAM may not appropriately determine the behavioral intention to use technology.

Even so, the review of the adoption and health care literature is imperative to ground this research and make it more applicable. From the mid-1980's, with the increased use of technology, researchers have had a desire to understand why individuals would be so inclined to accept a specific technology. This was the impetus of technology acceptance models. Even though this was the first introduction of theories that attempted to explain technology acceptance, TAM was built on a very strong base of research conducted decades earlier when scholars looked at how an individual's intention to perform a behavior led to the actual behavior.

This chapter includes an overview of technology acceptance models that are well known in the information systems field. While this may seem redundant, it is important because PTAM is built on the Extended TAM. Also included in this chapter is an overview of the behavioral psychology literature that is important to the technology acceptance models because they are the impetus to these theories. Because the PDA and health care are the focus technology and the focus environment, respectively, several articles are presented that study these items. But equally, if not more important in this literature review, is a presentation of several articles where adoption predictions are incorrect because technology acceptance models purport significant relationships that are not corroborated by the studies.

## 2.1. Behavioral Psychology Literature

### 2.1.1. The Unified Theory of Acceptance and Use of Technology

Numerous theories from the field of behavioral psychology have been partially successful in explaining why individuals accept a new information technology. Empirical tests of individual models prior to 2003 found some theories to account for as much as 50 percent of the variance in individual use and/or the behavioral intention to use information technology. Venkatesh et al. (2003) tested a total of 32 constructs from eight theoretical models simultaneously to determine the constructs that had the most influence on information technology use. The eight theories considered were: The *Theory of Reasoned Action* (Fishbein et al. 1975), *TAM* (Davis 1989; Venkatesh et al. 2000), the *Motivational Model* (Davis et al. 1992b), the *Theory of Planned Behavior* (Ajzen 1991), a model combining *TAM* and the *Theory of Planned Behavior* (Taylor et al. 1995b), the *Model of PC Utilization* (Thompson et al. 1991) , the *Social Cognitive Theory* (Bandura 1986), and the *Innovation Diffusion Theory* (Rogers 1995). An overview of each of these models can be found in Table 2 beginning on page 25 which is extracted from Venkatesh et al. (2003).

Venkatesh et al. (2003) conducted a longitudinal study where data were obtained from subjects who were presented with similar information technology applications at three different times. These points in time were: immediately following training (but prior to the introduction of a new information technology application), one month after

**Table 2 – Behavioral Psychology Literature**

(adapted from (Venkatesh et al. 2003, pp. 427-430))

| Models and Theories of Individual Acceptance | | |
|---|---|---|
| **The Unified Theory of Acceptance and Use of Technology** | | |
| **Description** | **Core Constructs** | **Definitions** |
| Combines eight models to produce a model that explains 69% of the variance in use behavior (Venkatesh et al. 2003). | Performance Expectancy | "The degree to which the user expects that using the system will help him or her attain gains in job performance." |
| | Effort Expectancy | "The degree of ease associated with the use of the system." |
| | Social Influence | "The degree to which an individual perceives that important others believe that he or she should use the new system." |
| | Facilitating Conditions | "The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system." |

| Theory of Reasoned Action | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| Drawn from social psychology, the Theory of Reasoned Action is one of the most fundamental and influential theories of human behavior. It has been used to predict a wide range of behaviors (see Sheppard et al. 1988 for a review). Davis et al. (1989) applied the Theory of Reasoned Action to individual acceptance of | Attitude Toward Behavior | "[A]n individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein et al. 1975, p. 216). |
| | Subjective Norm | "[T]he person's perception that most people who are important to him think |

| | | |
|---|---|---|
| technology and found that the variance explained was largely consistent with studies that had employed the Theory of Reasoned Action in the context of other behaviors. | | he should or should not perform the behavior in question" (Fishbein et al. 1975, p. 302). |

| **TAM and the Extended TAM** | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| TAM is tailored to IS contexts and was designed to predict information technology acceptance and usage on the job. Unlike Theory of Reasoned Action, the final conceptualization of TAM excludes the attitude construct in order to better explain intention parsimoniously. The Extended TAM extended TAM by including subjective norm as an additional predictor of intention in the case of mandatory settings (Venkatesh et al. 2000). TAM has been widely applied to a diverse set of technologies and users. | Perceived Usefulness | "[T]he degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). |
| | Perceived Ease of Use | "[T]he degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320). |
| | Subjective Norm | Adapted from the Theory of Reasoned Action. Included in the Extended TAM only. |

| Motivational Model | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| A significant body of research in psychology has supported general motivation theory as an explanation for behavior. Several studies have examined motivational theory and adapted it for specific contexts. Vallerand (1997) presents an excellent review of the fundamental tenets of this theoretical base. Within the information systems domain, Davis et al. (1992b) applied motivational theory to understand new technology adoption and use (Venkatesh et al. 1999). | Extrinsic Motivation | The perception that users will want to perform an activity "because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself such as improved job performance, pay, or promotions" (Davis et al. 1992b, p. 1112). |
| | Intrinsic Motivation | The perception that users will want to perform an activity "for no apparent reinforcement other than the process of performing the activity per se" (Davis et al. 1992a, p. 1112). |

| Theory of Planned Behavior | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| The Theory of Planned Behavior extended the Theory of Reasoned Action by adding the construct of perceived behavioral control. In the Theory of Planned Behavior, perceived behavioral control is theorized to be an additional determinant of intention and behavior. Ajzen (1991) presented a review of several studies that successfully used the Theory of Planned Behavior to predict intention and behavior in a wide variety of settings. The Theory of Planned Behavior has been successfully applied to the understanding of individual acceptance and usage of many different technologies (Ajzen 1991; Harrison et al. 1997; Mathieson 1991; Taylor et al. 1995b). A related model is the Decomposed Theory of Planned Behavior (DTPB). In terms of predicting intention, DTPB is identical to the Theory of Planned Behavior. In contrast to the Theory of Planned Behavior but similar to TAM, DTPB "decomposes" attitude, subjective norm, and perceived behavioral control into its underlying belief structure within technology adoption contexts. | Attitude Toward Behavior | Adapted from the Theory of Reasoned Action. |
| | Subjective Norm | Adapted from the Theory of Reasoned Action. |
| | Perceived Behavioral Control | "[T]he perceived ease or difficulty of performing the behavior" In the context of IS research, "perceptions of internal and external constraints on behavior" (Taylor et al. 1995b, p. 149). |

| Combined TAM/Theory of Planned Behavior | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| This model combines the predictors of the Theory of Planned Behavior with perceived usefulness from TAM to provide a hybrid model (Taylor et al. 1995a). | Attitude Toward Behavior | Adapted from the Theory of Reasoned Action / the Theory of Planned Behavior. |
| | Subjective Norm | Adapted from the Theory of Reasoned Action / the Theory of Planned |

| | | |
|---|---|---|
| | | Behavior. |
| | Perceived Behavioral Control | Adapted from the Theory of Reasoned Action / the Theory of Planned Behavior. |
| | Perceived Usefulness | Adapted from TAM. |

| **Model of PC Utilization** | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| Derived largely from Triandis' (1977) theory of human behavior, this model presents a competing perspective to that proposed by the Theory of Reasoned Action and the Theory of Planned Behavior. Thompson et al. (1991) adapted and refined Triandis' model for IS contexts and used the model to predict PC utilization. However, the nature of the model makes it particularly suited to predict individual acceptance and use of a range of information technologies. Thompson et al. (1991) sought to predict usage behavior rather than intention. | Job-fit | "[T]he extent to which an individual believes that using [a technology] can enhance the performance of his or her job" (Thompson et al. 1991, p. 129). |
| | Complexity | Based on Rogers and Shoemaker (1971), "the degree to which an innovation is perceived as relatively difficult to understand and use" (Thompson et al. 1991, p. 128). |
| | Long-term Consequences | "Outcomes that have a pay-off in the future" (Thompson et al. 1991, p. 129). |
| | Affect Towards Use | Based on Triandis, affect toward use is "feelings of joy, elation, pleasure, depression, disgust, displeasure, or hate associated by an individual with a particular act" (Thompson et al. 1991, p. 127). |
| | Social Factors | Derived from Triandis, social factors are "the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements |

| | | |
|---|---|---|
| | | that the individual has made with others, in specific social situations" (Thompson et al. 1991, p. 126). |
| | Facilitating Conditions | Objective factors in the environment that observers agree make an act easy to accomplish. For example, returning items purchased online is facilitated when no fee is charged to return the item. In an IS context, "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (Thompson et al. 1991, p. 129). |

| Innovation Diffusion Theory | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| Grounded in sociology, the Innovation Diffusion Theory (Rogers 1995) has been used since the 1960s to study a variety of innovations ranging from agricultural tools to organizational innovation (Tornatzky et al. 1982). Within information systems, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers and refined a set of constructs that could be used to study individual technology acceptance. Moore and Benbasat (1996) found support for the predictive validity of these innovation characteristics (Agarwal et al. 1997; Agarwal et al. 1998; Karahanna et al. 1999; Plouffe et al. 2001). | Relative Advantage | "[T]he degree to which an innovation is perceived as being better than its precursor" (Moore et al. 1991, p. 195). |
| | Ease of Use | "[T]he degree to which an innovation is perceived as being difficult to use" (Moore et al. 1991, p. 195). |
| | Image | "The degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore et al. 1991, p. 195). |
| | Visibility | The degree to which one can see others using the system in the organization (adapted from Moore et al. 1991). |
| | Compatibility | "[T]he degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters" (Moore et al. 1991, p. 195). |
| | Results Demonstrability | "[T]he tangibility of the results of using the innovation, including their observability and communicability" (Moore et al. 1991, p. 203). |
| | Voluntariness of Use | "the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore et al. 1991, p. 195). |

| Social Cognitive Theory | | |
|---|---|---|
| **Description** | **Core Constructs** | **Definitions** |
| One of the most powerful theories of human behavior is the Social Cognitive Theory (see Bandura 1986). Compeau and Higgins (1995) applied and extended the Social Cognitive Theory to the context of computer utilization (see also Compeau et al. 1999). Compeau and Higgins' (1995) model studied computer use but the nature of the model and the underlying theory allow it to be extended to acceptance and use of information technology in general. The original model of Compeau and Higgins (1995) used usage as a dependent variable. | Outcome Expectations—Performance | The performance-related consequences of the behavior. Specifically, performance expectations deal with job-related outcomes (Compeau et al. 1995) |
| | Outcome Expectations—Personal | The personal consequences of the behavior. Specifically, personal expectations deal with the individual esteem and sense of accomplishment (Compeau et al. 1995). |
| | Self-efficacy | Judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task. |
| | Affect | An individual's liking for a particular behavior (e.g., computer use). |
| | Anxiety | Evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer). |

introduction, and three months after introduction. These authors developed survey instruments that were consistent with the methods used in previous studies involving each theory. From analysis, the researchers identified the level of influence that the constructs of each of the eight theories had on technology adoption. The authors then used the most influential constructs for a new model, UTAUT (shown in Figure 3), with four core determinants of usage and intention, and up to four moderators of key relationships. In testing UTAUT using the original data, the researchers found the new model to outperform each of the eight individual models ($R^2$ = 69 percent).

UTAUT purports that three constructs (comprised of the most influential constructs of the eight theories) are the main determinants of intention to use information technology. These constructs are performance expectancy, effort expectancy, and social influence.

- **Performance Expectancy** – "The degree to which the user expects that using the system will help him or her attain gains in job performance" (Venkatesh et al. 2003, p. 447). Five constructs from the eight behavioral theories contribute to performance expectancy. These include: extrinsic motivation from the Motivational Model, relative advantage from the Innovation Diffusion Theory, perceived usefulness from TAM/Extended TAM and combined TAM/Theory of Planned Behavior, job fit from the Model of PC Utilization, and outcome expectations from the Social Cognitive Theory.

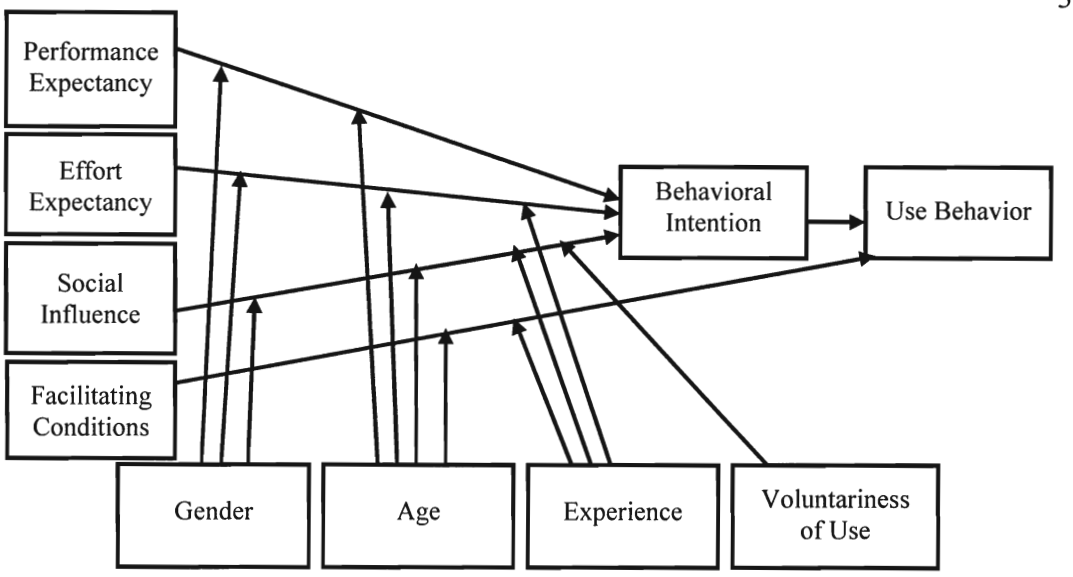



**Figure 3 – Unified Theory of Acceptance and Use of Technology (UTAUT)**

- **Effort Expectancy** – "…the degree of ease associated with the use of the system" (Venkatesh et al. p. 450). Three constructs from the theories reviewed measure some dimension of effort expectancy. These are: perceived ease of use from TAM/the Extended TAM, complexity from the Model of PC Utilization, and ease of use from the Innovation Diffusion Theory.
- **Social Influence** – "…the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al. p. 451). Three constructs from the individual models capture the concept of social influence. These are: subjective norm from the Theory of Reasoned Action, the Extended TAM, the Theory of Planned Behavior, and the Combined TAM/Theory of Planned Behavior, social factors in the Model of PC Utilization, and image in the Innovation Diffusion Theory.

UTAUT proposes two influences on information technology use: intention, and a new construct, called facilitating conditions. According to Venkatesh et al. (2003), facilitating conditions are defined as follows:

- **Facilitating Conditions** – "…the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system" (Venkatesh et al. 2003, p. 453). Three constructs from earlier theories have attempted to measure facilitating conditions. They include: facilitating conditions from the Model of PC Utilization, perceived behavioral control from the Theory of Planned Behavior and the Combined TAM/Theory of Planned Behavior, and compatibility from the Innovation Diffusion Theory.

Two empirical tests of UTAUT suggest that gender, age, prior experience, and voluntariness of system use moderate the influence of the main constructs on intention and the use of information technology. First, effort expectancy inversely affects intention and was stronger for older workers, women, and those with limited experience. Second, performance expectancy directly affects intention and was stronger for younger workers and men. Third, facilitating conditions inversely affects actual use and was stronger for those with more experience and older workers. And finally, the effect of social influence on intention was stronger for older workers, women, those using the system under mandatory conditions, and those with limited experience.

UTAUT makes an enormous contribution towards information systems research. The theory synthesizes years of behavioral psychology theory into a model that consists of only the most influential constructs that affect intention to use and actual information

technology use. The identification of the constructs informs individuals of how to focus their efforts in order to determine the features of new information technologies and the conditions of the environment that are needed to increase the probability of adoption.

Even though technology acceptance models have explained up to 69 percent of the variance of the behavioral intention to use, UTAUT and the other technology acceptance models have several major shortcomings that are significant. These shortcomings include: 1) the models focus exclusively on individual perceptions of external circumstances that lead to behavioral intention and actual behavior, 2) the models have repeatedly failed to predict intentions and usage in many studies, and 3) the models have been absent of qualitative data collection and analysis which can offer answers to questions that have not been obtained using quantitative methods.

The fact that technology acceptance models focus on individual behaviors leaves out the consideration of any objective environmental factors that may influence use. With the application of the models being context dependent, it is a coincidence that little attention is given to the context in which information technology is used. A single application of the acceptance models only considers one individual's behavior. In actuality, many individuals' behaviors may be necessary to have information technology used. At an organizational level, many people may be responsible for the implementation of information technology. This may include hospital administration, hospital information technology personnel, a clinic billing organization, persons responsible for implementing HIPAA, or the physician, who must interact with information technology and the patients daily for its use to be meaningful.

Another tremendous shortcoming found in technology acceptance models is the failure to predict intention and usage. There have been numerous studies, across different industries, where the model fails to predict as purported (Legris et al. 2003). While there are positives with having a model that generally predicts technology adoption and use, the previous technology acceptance models have lacked the ability to accurately predict technology usage in several industries (e.g., health care).

Additionally, the models lack qualitative data collection and analysis which has the propensity to supplement the quantitative explanations. This is especially true if a construct that a specific model theorizes to be able to predict is weak or non-significant.

Even with shortcomings, UTAUT, and the other technology acceptance models, are decent predictive models. UTAUT is based on constructs from several behavioral theories developed to predict information technology use. Now, theories that UTAUT is based on are reviewed to understand the role that each construct plays in user acceptance of new technology. The theories that are reviewed are: the Theory of Reasoned Action, the Theory of Planned Behavior, TAM, the Extended TAM, the Combined TAM/Theory of Planned Behavior, the Motivational Model, the Social Cognitive Theory, and the Innovation Diffusion Theory.

Many of the UTAUT's constructs have evolved from models associated with the Behavioral Intention Framework. This framework is a model originally associated with the work of Fishbein et al. (1975) and Ajzen et al. (1980), known as the Theory of Reasoned Action.

### 2.1.2. Theory of Reasoned Action

Fishbein et al. (1975) and Ajzen et al. (1980) developed the Theory of Reasoned Action (shown in Figure 4) to explain behavior based on an individual's expectations of behavioral outcomes. The model assumes that man is a rational processor (Fishbein et al. 1975) who decides which behaviors to perform, or not perform, by evaluating the outcomes that are likely to occur as a result. Intention to perform a behavior – the immediate antecedent of a behavior's performance – is formed by the interrelation of an individual's beliefs he holds about the subjective norm and the attitude toward performing a behavior. The core constructs that determine behavioral intention rely on basic assumptions about attitudes and beliefs. Attitudes are defined as an individual's positive or negative feelings toward an object or behavior. Attitude formation is an iterative process by which an individual considers a small number of salient beliefs related to a particular behavior. Individuals form attitudes toward a particular behavior by

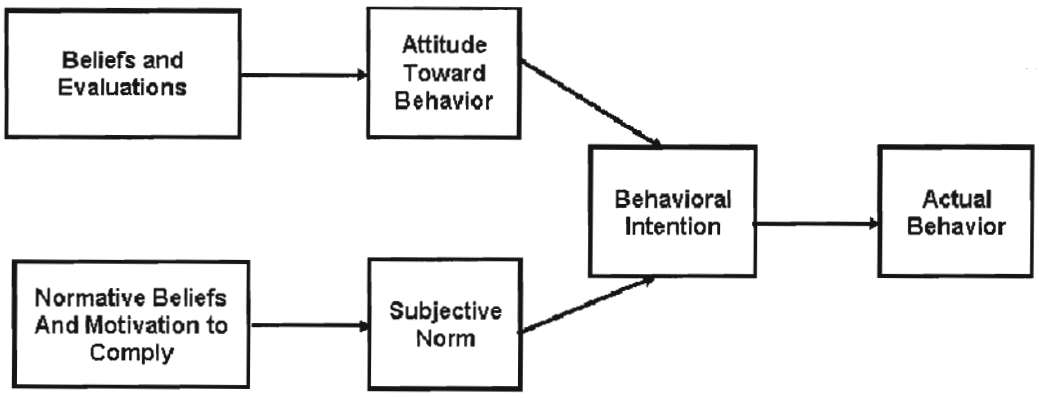



**Figure 4 – Theory of Reasoned Action**

evaluating their beliefs through an expectancy-value model, as shown in Equation 1. The expectancy-value model suggests that for each belief, in a given set of beliefs, the individual multiplies their evaluation of each belief by the subjective probability that the belief has that attribute and then sums the products for the total set of salient beliefs. In Equation 1, $A_B$ represents the attitude toward behavior B; $b_i$ is the belief (subjective probability) that performing the behavior B will lead to outcome $i$; $e_i$ is the evaluation of outcome $i$; and the sum is over the $n$ salient beliefs (Ajzen et al. 1980, p. 120).

$$A_B = \sum_{i=1}^{n} b_i e_i$$

**Equation 1 – The Expectancy-Value Model**

A belief is a piece of information that an individual links to an object – in this case, behavior. Beliefs have several dimensions including the qualitative attributes of that belief (e.g., tapping the stylus on the calendar icon on my PDA opens up my schedule), as well as belief strength, the subjective probability that this belief possesses that attribute (e.g., I believe that ten times out of ten, tapping the stylus on the calendar icon on my PDA opens up my schedule).

Beliefs fall into two categories based on how they are formed. Descriptive beliefs are formed by direct observation of particular attributes of an object – these tend to be relatively objective. Inferred beliefs are not formed on the basis of direct observation of attributes linked to an object. Rather, the beliefs that attributes are linked to an object rely on previously held beliefs, a connection posited by another source, or personal factors. For this reason, inferred beliefs may tend to be more subjective than those formed by

direct observation. While individuals may hold many beliefs, they focus on relatively few of the salient ones in the evaluation of a behavior's outcomes.

The following are the core constructs of the Theory of Reasoned Action:

- **Subjective norm** – An individual's perception that persons, who are important to him, or referents, believe that he should or should not perform a particular behavior. Individuals use a method similar to the expectancy-value model to assess the weight of the subjective norm in determining behavior. For each, in a given set of normative beliefs, individuals multiply the belief strength by the motivation to comply with that referent, then sum the entire set of resulting weights.
- **Attitude toward the behavior** – The extent to which an individual negatively or positively values the performance of a particular behavior. Individuals use an expectancy-value model to evaluate their beliefs to form this attitude.
- **Behavioral intention** – The expression of the desire to perform a given behavior. Behavioral intention is assumed to be the immediate antecedent of the performance of B.

As can be seen in Figure 4 on page 38, in the Theory of Reasoned Action, subjective norm and attitude jointly determine behavioral intention, which leads to the performance of behavior. The Theory of Reasoned Action has demonstrated a strong predictive ability for behavior in a variety of settings (e.g., Fishbein et al. 1989; Sheppard et al. 1988; Shimp et al. 1984). While the majority of these applications have been used to explain individual choices regarding health related behavior, several studies have

attempted to use the Theory of Reasoned Action to explain information technology adoption.

Using the Theory of Reasoned Action to explain use of a word processing application by MBA students, Davis (1989) administered a questionnaire to students just after an orientation to an application, but prior to use (T1) and then after a semester of use (T2). Analysis showed that the Theory of Reasoned Action model accounted for approximately 32 percent and 26 percent of the variance of behavioral intention at T1 and T2, respectively. Behavioral intention was highly correlated with actual use, or behavior. As for the individual constructs, attitude was found to have a significant influence on behavioral intention. Subjective norm, however, was shown to have a minimal influence on behavioral intention.

The Theory of Reasoned Action was tested again in the context of information technology adoption in a study of consumer intention to use online shopping outlets (Shim et al. 1990). The sample for this study was drawn randomly from a list purchased from a direct mail vendor. Subjects were mailed a questionnaire that was developed with demographic items and items based on the Theory of Reasoned Action. Analysis found that the overall Theory of Reasoned Action strongly predicted intention. Differing from Davis' study, subjective norm was shown to have a stronger effect on determining behavioral intention than attitude. Respondents to this survey were 80 percent female and 68 percent married. The difference in sample composition might explain the differing influence of subjective norm. This is because Davis' study used students who are on average younger and possibly more impressionable.

The Theory of Reasoned Action presents a behavioral model with strong predictive power. Both studies in the information technology context demonstrate the overall strength of the model. The two core constructs – attitude and subjective norm – have been shown to influence intention and behavior.

### 2.1.3. Theory of Planned Behavior

The Theory of Reasoned Action is valuable in predicting behavior where the behavior in question is completely under the individual's own volition. Ajzen (1991) expanded the Theory of Reasoned Action to include one more construct and renamed the model the Theory of Planned Behavior (shown in Figure 5). This newly added construct, *perceived behavioral control, co*nsiders the influence that user perceptions of external constraints have on behavioral intention and actual behavior.

Perceived behavioral control is composed of an individual's perceptions that they are able to perform a particular behavior. Individuals assess perceived behavioral control using a method similar to the expectancy-value model. For each in a set of control beliefs – those related to factors inhibiting or supporting an individual's ability to perform a behavior – individuals multiply the belief's strength by the perceived power of the control factor. As seen in Figure 5, the Theory of Planned Behavior model is very similar to the Theory of Reasoned Action. However, perceived behavioral control is a third antecedent of behavioral intention.

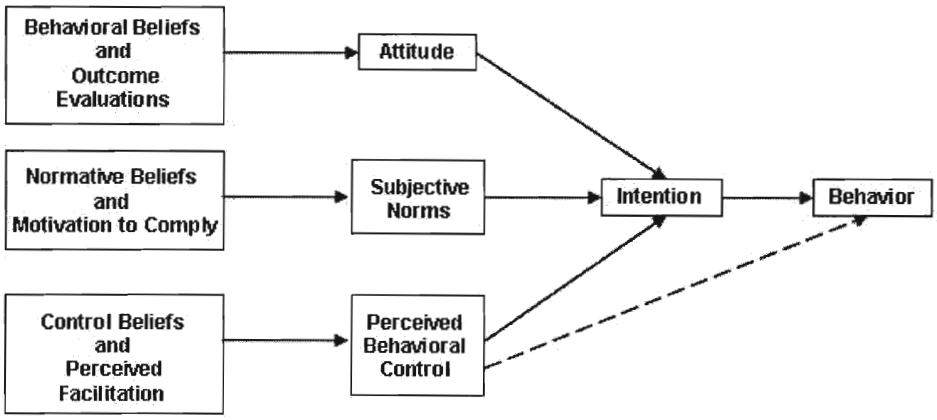



**Figure 5 – Theory of Planned Behavior**

Empirical tests in the information systems context find that the introduction of perceived behavioral control strengthens the Theory of Reasoned Action's predictive ability. A study related to college students' intentions to perform a series of behaviors, demonstrated that the Theory of Reasoned Action accounts for a larger amount of variance in behavioral intention when the perceived behavioral control construct is included (Madden et al. 1992). Following the introduction of the Theory of Planned Behavior, a number of empirical studies have demonstrated similar findings in a variety of behavioral contexts (Ajzen 1991).

In a test of the predictive ability of the Theory of Planned Behavior, the model was able to explain approximately 70 percent of the variance in intention of a college students' use of spreadsheet software (Mathieson 1991). Analysis found that the attitude accounted for only slightly more variance in behavioral intention than perceived behavioral control. However, subjective norm was found to have a relatively weak effect on behavioral intention. The findings related to overall model strength and subjective

norm weakness are also consistent with an application of the Theory of Planned Behavior to small business executives intention to use a variety of information technologies (Harrison et al. 1997).

The Theory of Planned Behavior adds to the Theory of Reasoned Action's contribution to a research framework for information systems. The Theory of Planned Behavior's overall predictive ability for explaining intention to use technology seems to be stronger than the Theory of Reasoned Action. This may be due to its consideration of external constraints related to information technology use – which is measured in terms of the individual's perceptions of behavioral control. It is important to note that the role of subjective norm in predicting intention to use technology has been brought into question by empirical tests of the Theory of Planned Behavior.

### 2.1.4. The Technology Acceptance Model

Davis (1989) used the Theory of Reasoned Action with the intention of creating a model based on the behavioral intentional framework that is suited to explaining and predicting end user adoption of information technology. TAM continues to focus on behavioral intention as the antecedent of actual behavior, but with two significant changes that suggest attitude directly influences behavioral intention. These are:

1) TAM excludes the subjective norm construct included in Theory of Reasoned Action and the Theory of Planned Behavior. Davis suggests that in an organizational setting, individuals may choose to use technology to perform their job or because their normative referents encourage them to do so. Davis

(1986) says that previous measures of subjective norm are unable to capture the difference between external requirements and internal motivation to comply, and

2) Instead of focusing on general beliefs (as in the Theory of Planned Behavior and the Theory of Reasoned Action), TAM includes two new constructs that refer to specific beliefs influencing attitude toward the intention to use information technology.

The new constructs in TAM are:

- **Perceived ease of use** – "the degree to which an individual believes that using a particular system would be free of physical or mental effort" (Davis 1986, p. 26 ), and
- **Perceived Usefulness** – "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p. 26 ).

Ease of use is posited to directly affect attitude. It also indirectly affects attitude through its influence on usefulness. Usefulness is posited and demonstrated to directly affect behavioral intention. Many empirical tests confirm these relationships. TAM is shown in **Error! Reference source not found.** on page **Error! Bookmark not defined.**.

Much research has confirmed both the relationships among the constructs and the predictive strength of TAM (Davis 1989; Davis et al. 1989). Perceived usefulness and perceived ease of use were highly correlated with current and predicted use. Regression analysis of these data suggests that ease of use is an antecedent of perceived usefulness.

Two studies compare TAM with the behavioral intention frameworks of the Theory of Planned Behavior and Theory of Reasoned Action. Davis et al. (1989) compared the Theory of Reasoned Action and TAM models side by side and found that TAM had superior predictive strength over the Theory of Reasoned Action. The Theory of Reasoned Action accounted for approximately 30 percent of variance in behavioral intention while TAM accounted for closer to 50 percent. Subjective norm was again observed to have negligible effect on behavioral intention. Mathieson (1991) compared TAM and the Theory of Planned Behavior side by side to explain college students' use of spreadsheet software applications. In this study, TAM accounted for nearly 70 percent of the variance in behavioral intention. Again, subjective norm was shown to have little effect on behavioral intention.

### 2.1.5. The Extended Technology Acceptance Model

The original TAM's instruments were developed and validated for the perceived usefulness and perceived ease of use variables. These two variables were hypothesized to determine computer usage. Additionally, perceived ease of use is an antecedent of perceived usefulness. The scales that were developed exhibited significant empirical relations with self-reported measures of usage behavior and had strong psychometric properties (Davis 1989, p. 332-333).

In 2000, Venkatesh and Davis developed and tested a theoretical extension to TAM known as the Extended TAM (shown in Figure 2, page 12). As can be seen, the extended model includes several additional determinants of perceived usefulness. The

model still purports that perceived ease of use contributes to both perceived usefulness and influences the behavioral intention to adopt. Even with TAM based on the Theory of Reasoned Action, as stated, Davis (1989) did not include social and cognitive influential processes as a part of the original model. The Extended TAM includes three additional social influences that the authors say determine a user's intention to accept or reject a system. These three variables are subjective norm, voluntariness, and image. Additionally, the Extended TAM has four cognitive instrumental processes (i.e., job relevance, output quality, result demonstrability, and perceived ease of use). Consistent with the Theory of Reasoned Action, Venkatesh and Davis (2000) integrate social influence into the Extended TAM by using subjective norm.

As stated above, Fishbein and Ajzen (1975, p. 302) operationalize subjective norm as an individual's perception that people that are important to her think that she should (or should not) perform the specific behavior. Subjective norm is a direct effect in Theory of Reasoned Action and the Extended TAM. An example of social norm would be that a physician may choose to perform a specific behavior (e.g., look up a drug interaction on a PDA). The doctor would use her PDA to perform this activity if she believes that an individual, or group of individuals, important to her, thinks that she should look up the drug, and she is motivated to comply.

According to French and Raven (1959) and Warshaw (1980) subjective norm's direct compliance effect on intention is theorized to occur if a person perceives that a social actor, such as a mentor, peer, or boss, would like him to perform a behavior, and the actor has the ability to punish or reward the behavior. The effect of subjective norm

on intention has shown varying results (Davis et al. 1989; Mathieson 1991; Taylor et al. 1995a). Because of this inconsistency, Hartwick and Barki (1994) studied compliance and voluntariness with social influence. They found that in mandatory settings, subjective norm had a significant effect on intention; however, this is not the case in voluntary settings. Additionally, Hartwick and Barki purport that even in organizations where system use is mandatory, a subset of users can be reluctant to comply. Ives, Olson, and Baroudi (1983) contend that increased user intentions are not always preceded by positive attitudes, especially in a mandatory setting.

Voluntariness is a moderating variable in the Extended TAM and is defined as that extent that possible adopters perceive the adoption decision to be voluntary (Agarwal et al. 1997; Hartwick et al. 1994; Moore et al. 1991). With an intervention from managers, beliefs about usefulness are positively effected (Lucas et al. 1990) and intention to use increases (Leonard-Barton et al. 1988). The authors of the Extended TAM reported a positive direct effect on the behavioral intention to use if system use was perceived to be non-voluntary.

Warshaw (1980) contends that internalization occurs if an individual perceives that an important person thinks that they should use a system, then the individual includes the important person's belief into their our belief system. Identification refers to a person's image within a social group. Venkatesh and Davis (2000) say that subjective norm will positively influence image. This is because if important people that are part of an individual's reference group believes that a behavior should be performed, then doing so will elevate their standing within the group (Blau 1964; Kiesler et al. 1969). Rogers

(1995) says that image is the perception of how much one enhances their status in their social system due to the use of an innovation. Many times individuals respond to social normative influences to establish or maintain a favorable image within a reference group (Kelman 1958).

The Extended TAM uses constructs from the theoretical foundation of previous studies. The cognitive determinants is from motivation theory (Vroom 1964), action theory from social psychology (Fishbein et al. 1975), and task-contingent decision making from behavioral decision theory (Beach et al. 1978).

Moore and Benbasat (1991) say that if people have a difficult time attributing gains in their job performance to the use of a system then even effective systems will not be accepted. The tangibility of the results of using the systems is *result demonstrability.* In the Extended TAM, result demonstrability influences perceived usefulness. Agarwal and Prasad (1997) found a significant correlation between result demonstrability and usage intentions. Venkatesh and Davis (2000) contend that perceived usefulness and result demonstrability is consistent with the job characteristic model. This model stress knowledge of the actual results of work activities as a key psychological state underlying work motivation (Hackman et al. 1976; Loher et al. 1985).

The Extended TAM was applied in a longitudinal study to four organizations using four different computer systems. These four organizations were in manufacturing, accounting, financial services and investment banking. Use was mandatory at two of the sites and use was voluntary at the other two organizations. Data gathering was accomplished via a questionnaire and the constructs of the model were measured 12

times (three times at each of the four sites). The measurement times were pre-implementation, one month post-implementation, and three months post-implementation. There was a sample size of 156 per time period and 468 across all three time periods. Since the sample size in each organization was less that 50 per study, the overall power of the significance test was lower than desired.

The Extended TAM was supported for all four sites at all times of measurement and explained between 34 percent – 52 percent of the variance in usefulness perceptions and between 40 percent – 60 percent of the variance in usage intentions. Venkatesh and Davis (2000) found that cognitive instrumental processes and social influence processes influenced user acceptance. In summary, these authors found that the Extended TAM extends TAM by showing that subjective norm has a significant effect on the intention to use technology and that this effect is over and above *perceived ease of use* and *perceived usefulness* for mandatory, not voluntary systems (p. 198).

The hypotheses presented by Venkatesh and Davis (2000), which were all corroborated are:

- Hypothesis 1a. *Subjective norm will have a positive direct effect on intention to use when system use is perceived to be mandatory.*
- Hypothesis 1b. *Subjective norm will have no significant direct effect on intention to use when system use is perceived to be voluntary.*
- Hypothesis 1c. *Voluntariness will moderate the effect of subjective norm on intention to use.*

- Hypothesis 2. *Subjective norm will have a positive direct effect on perceived usefulness.*
- Hypothesis 3a. *Subjective norm will have a positive effect on image.*
- Hypothesis 3b. *Image will have a positive effect on perceived usefulness.*
- Hypothesis 4a. *The positive direct effect of subjective norm on intention for mandatory systems will attenuate with increased experience.*
- Hypothesis 4b. *The positive direct effect of subjective norm on perceived usefulness will attenuate with increased experience for both mandatory and voluntary systems.*
- Hypothesis 5. *Job relevance will have a positive effect on perceived usefulness.*
- Hypothesis 6. *Output quality will have a positive effect on perceived usefulness.*
- Hypothesis 7. *Result demonstrability will have a positive effect on perceived usefulness.*
- Hypothesis 8. *Perceived ease of use will have a positive effect on perceived usefulness.*

### 2.1.6. Combined TAM/Theory of Planned Behavior

Taylor and Todd (1995a) introduced a model to explain technology use that was primarily based on TAM and the Theory of Planned Behavior. This consolidated model, the Combined TAM/Theory of Planned Behavior, joins the two aforementioned models by fully integrating the subjective norm construct. In testing the new constructs, these

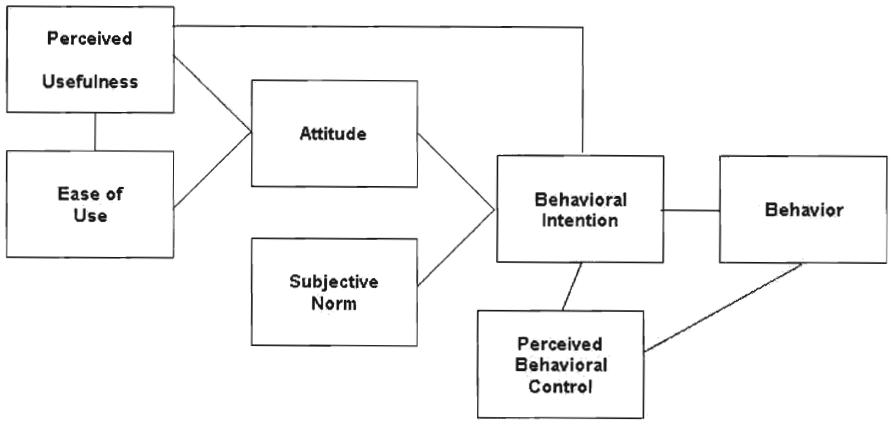



**Figure 6 – Combined TAM/Theory of Planned Behavior**

authors introduced an additional dimension of user experience known as prior use. Taylor and Todd (1995a) hypothesized that if subjects are separated into groups based on prior use of a particular technology, different strengths would be revealed in the influence of the Combined TAM/Theory of Planned Behavior constructs.

In order to test this model, Taylor and Todd (1995a) measured constructs in a college students' computer laboratory. A survey was completed by the students containing items which measured all of the constructs included in both TAM and the Theory of Planned Behavior. Student laboratory use was tracked in order to divide the students into two categories – experienced and inexperienced. The resulting analysis confirmed the model's strong overall predictive ability for the behavioral intention to use. Forty-three percent and sixty percent of the variance was explained for experienced and inexperienced users, respectively. Additionally, analysis of the two user groups suggested previous unobserved differences in the influences of the constructs leading to behavioral intention. Behavioral intention was a much stronger predictor of behavior for the experienced users than the inexperienced users. This may be because prior experience

shaped expectations. It was also found that perceived behavioral control had a stronger effect than usefulness on behavioral intention for experienced users. This may also suggest that prior experience shapes the beliefs contributing to attitude. For inexperienced users, behavioral intention appeared to be most strongly influenced by usefulness, which was followed by perceived ease of use. This suggests that inferred beliefs, rather than observed ones, about new technology contributes largely in determining this group's behavioral intention.

### 2.1.7. The Motivational Model

The Motivational Model purports that individual behavior is based on two central constructs – extrinsic and intrinsic motivation (Davis et al. 1992b). These two constructs are defined as:

1) **Extrinsic Motivation** - "The performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are different from the activity itself, such as improved job performance..." (p. 1112).

2) **Intrinsic motivation** – "The performance of an activity for no apparent reinforcement other than the performance of the activity, per se, such as enjoyment" (p. 1112).

Several of the models that have been reviewed earlier in this dissertation measure extrinsic motivation with constructs such as usefulness, subjective norm, and ease of use. In applying the motivational model in the context of technology, Davis (1992b) operationalized these constructs to measure their effects on behavioral intention. Intrinsic

motivation measured the use of technology in terms of its enjoyment. Extrinsic motivation was measured in terms of perceived usefulness. Both studies introduced software applications to college students. This introduction was followed by a questionnaire with items measuring the usefulness and enjoyment constructs as well as the intention to use the application (behavioral intention). Analysis showed that usefulness had a large effect on behavioral intention to use in the two studies. In addition, the effect of enjoyment on behavioral intention was significant; but weaker than the effect of usefulness. These studies suggest that the motivational model construct of enjoyment has a relatively weak effect on intention to use technology.

Similar results (a relatively weak effect of enjoyment and a relatively high effect of usefulness on behavioral intention) were found in another study that tested the Motivational Model. Igbaria, Parasuraman, and Baroudi (1996) surveyed 471 subjects in 62 companies to measure their perceptions and actual technology use. These authors found support for the considerations of several variables: perceived complexity, skills, organization support, and organization usage.

- **Perceived complexity** – Measured in terms of the degree to which computer technology is perceived as relatively difficult to use and understand.
- **Skills** – Defined as a combination of a user's computer skills, the overall experience with computers, and the training they obtained.
- **Organization support** – Assesses general support, which includes the allocation of resources and top management encouragement.

- **Organization usage** – Assessed by three items asking individuals to the level of usage of microcomputers by their subordinates, supervisors, and peers.

In looking at use, Igbaria et al. (1996) discovered that perceived complexity had a small, negative effect. It also had a stronger indirect effect on use through other variables. Organization usage and skills had strong effects and organization support had a much weaker effect. This suggests that the Motivational Model makes only limited contributions to information systems research. What is useful is the validation that organizational use and skill exert a significant influence on technology use.

### 2.1.8. Social Cognitive Theory

UTAUT has several constructs that come from the Social Cognitive Theory. The Social Cognitive Theory is a competitor of the Behavioral Intention framework and is associated with the work of Bandura (1986). The Social Cognitive Theory is based on the idea that environmental factors, personal factors, cognitive factors, and behaviors are determined reciprocally. This part of Bandura's behavioral model (known as reciprocal determinism) says that an individual's behavior is at once shaped by internal and personal factors, in addition to the environment. The Social Cognitive Theory research suggests a number of factors that control relationships among the three constructs. Studies that use the Social Cognitive Theory to explain behaviors related to technology have primarily dealt with the role of cognitive factors in individual behavior (Compeau et al. 1995; Compeau et al. 1999).

Compeau et al. (1995) research focuses on two sets of expectations as the main cognitive factors influencing behavior. The first set of expectations, self-efficacy, are related to individual beliefs about the ability to perform a given behavior. The second set, expected outcomes, says that persons are more likely to perform behaviors that they expect will have favorable outcomes. Measures that are similar to the Social Cognitive Theory's expected outcomes have been considered in several of the models already discussed (e.g., TAM). Self-efficacy is defined by Bandura (1986) as persons' judgments of their ability to organize and execute courses of action necessary to attain designated types of performances. Self-efficacy is not concerned with the skill that one has, but with judgments of what one can do with the skills that are possessed. From this definition it can be assumed that an appropriate level of behavioral specificity should be observed upon measuring self-efficacy.

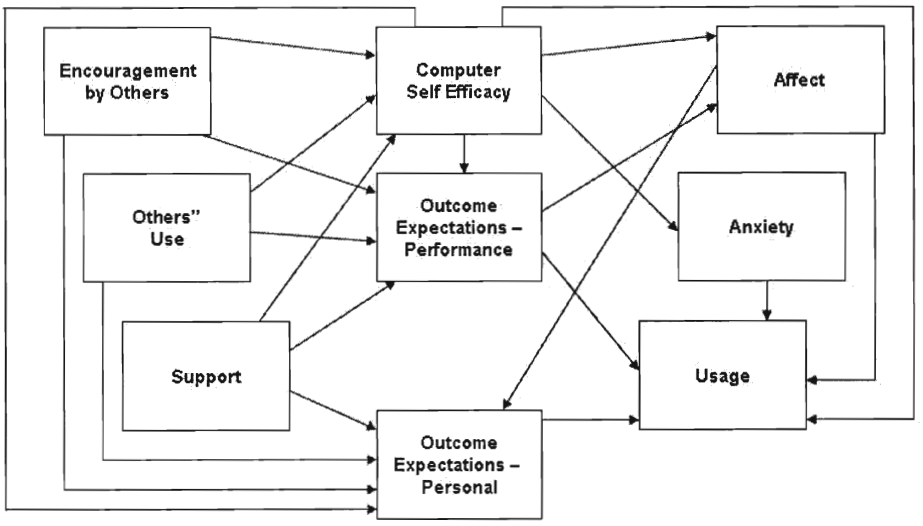



**Figure 7 – Social Cognitive Theory**

Compeau et al. (1999) assert that this definition implies two types of abilities: individual skills and a set of group skills related to the completion of a larger task. They go on to point out that measurement of the expectations that are related to self-efficacy should focus on the latter. These authors appropriately define computer self-efficacy as a judgment of one's capability to use a computer, rather than capabilities like formatting a disk or turning the machine off.

Bandura (1986) presents three dimensions of self-efficacy. Within the context of technology, Compeau et al. (1999) define the three dimensions:

- **Magnitude** – The level of capability to be expected. This may be a measure of the amount of assistance a person assumes they need to perform computer-based tasks. Or, it may be measured in terms of the level of complexity of computer-based tasks that an individual can perform.
- **Strength** – The confidence an individual has regarding the ability to perform a task or the level of conviction about the judgment to perform. This is similar to belief strength, where the belief is related to the individual's ability to perform a task and strength is the subjective probability that it can be performed successfully.
- **Generalizability** – The degree to which the judgment is limited to a particular activity or domain. In the technology context, generalizability would reflect the subject's belief that their skills in one area (e.g., using a computer to find directions) are transferable to another (e.g., using a computer to find tax forms).

Using these assumptions, Compeau and Higgins, (1995) developed a 10-item questionnaire to measure computer self-efficacy. The items focused on task-level specify, as opposed to individual skills. In addition, each item measured the magnitude and strength of computer self-efficacy by asking the subjects to initially indicate whether they could achieve the task and how confident they were that they could achieve it. The questionnaire was administered to a small sample of academic and business professionals whose positions involved processing a large amount of information. Consistent with Bandura's (1986) explanation of the Social Cognitive Theory, Compeau et al's. (1995) study sought to measure the effects of environmental, cognitive, and behavioral factors on computer self-efficacy. Other factors that were measured are: encouragement by others, other's use, organizational support, outcome expectations, affect, anxiety, and use. The hypotheses of Compeau et al. (1995) put computer self-efficacy with the environment, cognitive, and behavioral factors within a larger model.

The initial analysis of data suggested that the development of several constructs in the study were poor. Self-efficacy, affect, support, and use were valid measures. Items within the other constructs did not highly correlate with one another. Therefore, the initial model was restructured to reflect the differences among items consisting of these constructs.

Even given the problems with the model, the Social Cognitive Theory is a useful model for predicting computer use. The revised model accounts for 32 percent of the variance. In addition, the constructs of computer self-efficacy and outcome expectations appeared to be strong direct predictors of use.

In 1999, Compeau et al. verified the findings for outcome expectation and self-efficacy. An additional similar study by Compeau (1999) verified the findings for self-efficacy and outcome expectations. The Social Cognitive Theory contributes by verifying that computer self-efficacy and outcome expectations are important determinants in technology use. Additionally, the task level of specificity and the magnitude/strength may have contributed to the validity of these findings.

### 2.1.9. Innovation Diffusion Theory

Also included in UTAUT are constructs derived for the Innovation Diffusion Theory. The Innovation Diffusion Theory presents a model that explains the process by which innovations in technology are adopted by users. Rogers (1995) says that an innovation is a practice, idea, or object perceived as new by an individual or other unit of adoption. He defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" Rogers (1995, p. 5). Therefore, the Innovation Diffusion Theory focuses on explaining how new ideas and concepts receive widespread adoption.

Rogers (1995) considers several attributes associated with technological innovations that affect their rate of widespread adoption. These attributes are defined as:

- **Relative advantage** – The degree to which an innovation is perceived to be better than the idea it supersedes;
- **Compatibility** – The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters;

- **Complexity** – The degree to which an innovation is perceived as relatively difficult to understand and use;
- **Trialability** – The degree to which an innovation may be experimented with on a limited basis; and
- **Observability** – The degree to which the results of an innovation are visible to others.

Using variants of the Innovation Diffusion Theory, Rogers (1995) investigated the adoption of technological innovations in approximately 1,500 studies. The studies included agriculture, city planning, economic development, and healthcare. A smaller set of studies focused on how these attributes influence use and behavioral intention to use. The Innovation Diffusion Theory constructs were developed by identifying the product attributes that most influenced adoption.

Moore and Benbasat (1991) phrased Rogers' innovation attributes in terms of individuals' perception to test the influence they had on use and behavioral intention of technology. This was done by developing reliable and valid instruments to measure the effects that user perceptions of these attributes had on usage intention. In testing their measure, Moore and Benbasat found that several of the attributes of the Innovation Diffusion Theory model tapped more than one construct. The new list of constructs named by Moore and Benbasat as the perceived characteristics of innovating has several attributes that are nearly identical to Roger's. The new attributes are listed below.

- **Image** – The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.

- **Ease of use** – The degree to which an innovation is perceived as being difficult to use.
- **Compatibility** – The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters.
- **Results demonstrability** – The tangibility of the results of using the innovation including their observability and communicability.
- **Relative advantage** – The degree to which an innovation is perceived as being better than its precursor.
- **Voluntariness of use** – The degree to which the use of the innovation is perceived as being voluntary, or of free will.
- **Visibility** – The degree to which one can see others using the system in the organization.

The predictive ability of the perceived characteristics of innovating on technology use has been validated by several empirical tests. Plouffe, Hulland, and Vandernbosch (2001) used the perceived characteristics of innovating to measure individuals' use of a card-based electronic payment system. These authors were able to explain 45 percent of the variance in intention to use the system. Additionally, research has revealed that for potential adopters of new technology, the results demonstrability, ease of use, visibility, and trialability, significantly affect the intention to use (Karahanna et al. 1999).

**Table 3 – Summary of Health Care and PDA Technology Acceptance Articles**

| Title | Author (Year) | Article Summary |
|---|---|---|
| Exploring Information Technology Adoption by Family Physicians: Survey Instrument Valuation | Dixon and Stewart (2000) | • These authors present an instrument adapted from TAM.<br>• The instrument was given to 101 family care physicians.<br>• The result allowed for the stratification of physicians into high, intermediate, and low information technology usage groups.<br>• This article does not use the Extended TAM. |
| Adoption of Telemedicine Technology by Health Care Organizations: An Exploratory Study | Hu, Chau, and Sheng (2002) | • This article uses a framework proposed by Tornatzy and Fleisher (1990).<br>• A research model was developed for "targeted technology adoption."<br>• The model was empirically evaluated in a survey study.<br>• The research involved most Hong Kong public health care organizations. |
| Why Don't Physicians Use Their Personal Digital Assistants? | Lu, Lee, Xiao, Sears, Jacko, and Charters (2003) | • A descriptive structured interview study to examine PDA usage and non-usage patterns among physicians<br>• Four types of barriers were identified:<br>1) Organizational barriers,<br>2) Usability barriers,<br>3) Inadequate technology support or access barriers, and<br>4) The lack of need or motivation. |
| A Review of Diffusion of Personal Digital Assistants in Health care | Kuzimsky, Laul, and Leung (2005) | • Few studies exist that show how the adoption of the PDA impacts healthcare work processes and routines.<br>• The authors suggest that in order to convince health care organizations to use PDAs, evaluation studies must be conducted to show that the implementation of technology (like a PDA) "does not take precedent over patient care but actually helps to improve patient care" (p. 350). |
| Knowledge in the Palm of Your Hands: PDAs in the Clinical Setting | Honeybourne, Sutton, and Ward (2006) | • The article compares characteristics of the PDA in order to determine the impact of hand-held computers on patient care.<br>• The authors conclude that hand-held technology is emerging as an effective clinical tool to aid evidence-based practice and support the educational needs of clinical staff.<br>• A key point in providing evidence at the point of care is how fast the information can be delivered.<br>o Must be available within seconds to be included in busy clinical rounds.<br>o General practitioners will look less than two minutes for answers that arose in consultations. |

## 2.2. Health Care Literature

The behavioral psychology literature, as given in Section 2.1, forms much of the literature base to allow the rebuilding of technology acceptance models for physicians. Another major portion of the literature foundation is health care literature that researches technology acceptance and studies that use a PDA as the technology instantiation. This section contains such articles and is summarized in Table 3.

### 2.2.1. Dixon and Stewart (2000)

Dixon and Stewart (2000) test an instrument on 101 family practice physicians and then stratify the doctors into high, intermediate, and low information technology usage groups. Doing so, the authors conclude that it is now easier for managers of information technology implementations to direct specific adoption strategies for each group. The stratification occurred by differentiating the physicians' attitudes and views towards information technology. As depicted in Figure 8, the authors modified the Information Technology Adoption Model (ITAM) (Dixon et al. 1994) to provide a structure to identify areas for evaluation and to organize implementation techniques. The study model postulates that the users' perceptions lead to adoption behaviors (Dixon et al. 2000).

In Figure 8, the users' finesse signifies their willingness and ability to transfer skills and knowledge from one task to another. Knowledge is used as a proxy measurement for the individual's depth and breadth of knowledge. Depth refers to the

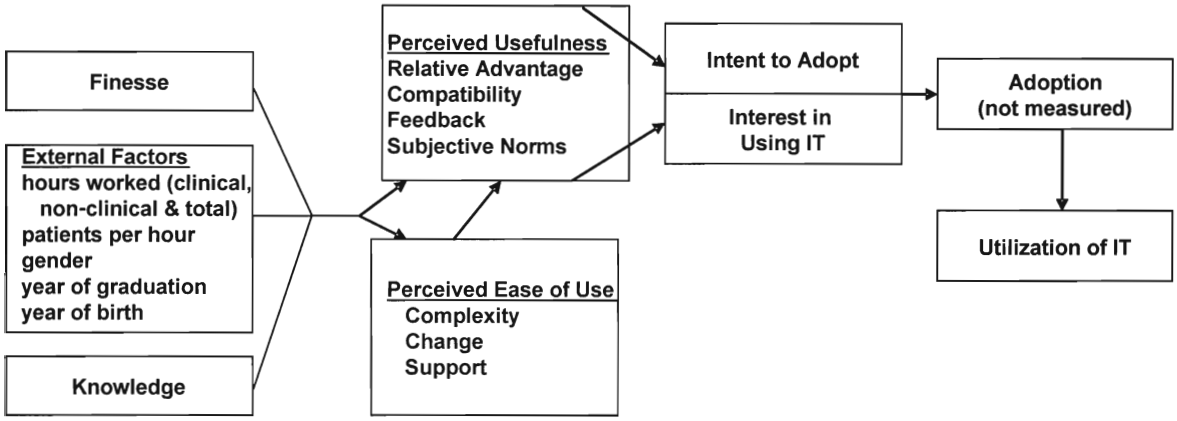



**Figure 8 – Modified ITAM**

individual's knowledge in each area and breadth refers to the array of knowledge areas the individual has. Perceived usefulness describes the perceptions of the individual toward the innovation. Items included in perceived usefulness are relative advantage, compatibility, feedback, and subjective norms. Perceived ease of use describes the individual's perception of how much the innovation is free of effort to use and includes complexity, change, and support.

### 2.2.2. Hu, Chau, and Sheng (2002)

Hu, Chau, and Sheng (2002) examined the essential management issues facing many health care organizations who either have or are interested in adopting telemedicine technology. These authors developed a research model, based on a framework introduced by Tornatzky and Fleisher (1990), for targeting technology adoption and they empirically evaluated the model in a survey study. The study participants were most of the public health care organizations in Hong Kong. The exploratory study suggested that the presented model "exhibits reasonable significance and explanatory utility to differentiate

between adopting and non-adopting organizations" (Hu et al. 2002, p. 197). Significant determinants of targeted technology adoption were the collective attitude of medical staff and perceived service risks.

### 2.2.3. Lu, Lee, Xiao, Sears, Jacko, and Charters (2003)

Lu, Lee, Xiao, Sears, Jacko, and Charters (2003) conducted a descriptive structured interview study to examine PDA usage and non-usage patterns among physicians. The purpose of the study was to record 1) how physicians use their PDAs, 2) functions and applications used, 3) functions and applications not used, 4) reasons and examples of why physicians do not use PDAs for those functions, and 5) the recall of specific incidents of PDA usage using Critical Incident Technique (CIT) (Lu et al. 2003). After codification and analyses of data from 20 interviews, these authors identified four types of barriers from the analysis. These barriers are: 1) organizational barriers (30 percent of subjects), 2) usability barriers (95 percent of subjects), 3) inadequate technology support or access barriers (85 percent of subjects), and 4) lack of need or motivation (100 percent of subjects).

### 2.2.4. Kuzimsky, Laul, and Leung (2005)

Kuzimsky, Laul, and Leung (2005) perform a review that is resultant from a comprehensive literature search of the adoption, usage, and impact of PDAs in health care. Providing such a review, the authors wish to increase awareness about the current state of adoption, usage, and impact of PDAs in healthcare and also encourage research to

further enhance the use of PDAs in healthcare. Adoption as defined by these authors is the rationale for, barriers to, and scope of adopting PDAs. Usage is defined as the types of health professionals using PDAs, the PDA's features, and its functionalities. Impact is perceived as actual outcomes, as well as the improved productivity from using a PDA.

The authors say that the literature indicates over the last few years, adoption has increased; however, there are few studies that show how the adoption of the PDA impacts healthcare work processes and routines. They also suggest that evaluation studies must be conducted to show that the implementation of technology (like a PDA) "does not take precedent over patient care but actually helps to improve patient care" (p. 350). Performing these evaluation studies would assist in convincing healthcare institutions to adopt and use PDAs.

### 2.2.5. Honeybourne, Sutton, and Ward (2006)

Using a descriptive study, Honeybourne, Sutton, and Ward (2006) compare characteristics of the PDA in order to determine the impact of hand-held computers on patient care. These authors conducted this research via a purposive sample of 14 clinical and librarian staff who participated in phase one and 14 in phase two. The two phases used different ways of accessing resources. These authors conclude that hand-held technology is "emerging as an effective clinical tool to aid evidence-based practice and support the educational needs of clinical staff" (Honeybourne et al. 2006, p. 51). They also indicate that the key point in providing evidence at the point of care is how fast the information can be delivered. Research has indicated that information must be available

within seconds to be included in busy clinical rounds (Sackett et al. 1993). In addition, general practitioners will search for less than two minutes for answers that arise in consultations (Ely et al. 1999). Drug information, guideline information, medical calculations, and administrative task were used most by the participants. The authors note that most clinical staff members are not technical experts and that time pressures require that they be provided information sources and instruction on how to use PDAs.

## 2.3. Evidence Contradicting Acceptance Models

Now that the foundation of the study is built, this section of the literature review focuses on the multitude of articles that contradict acceptance models. Legris, Ingham, and Collerette (2003) present a critical review of TAM where they review 22 TAM related articles in major information systems journals. Many of these articles, with results contrary to TAM predictions, are studies that are tested in health care environments. An overview of the contradictory articles that are presented in this section is summarized in Table 4.

### 2.3.1. Legris, Ingham, and Collerette's (2003) Critical Review of TAM

Legris et al. (2003) offer a critical review of TAM and the Extended TAM. These authors assert that empirical research that has used TAM or the Extended TAM "show that results are not totally consistent or clear" (p. 191). Additionally, these authors

**Table 4 – Articles that Review, Refine, or Contradict TAM / Extended TAM**

| Title | Author(s) (Year) | Evidence Contrary to Technology Acceptance Model Predictions |
|---|---|---|
| Why do people use information technology? A critical review of the technology acceptance model[2] | Legris, Ingham, and Collerette (2003) | • 12 of 22 articles reviewed had a non-significant or a significant reverse relationship.<br>• 36 percent of the articles that were reviewed which tested the Extended TAM's predicted relationship between attitude and the behavioral intention to use showed no relationship. |
| An Empirical Assessment of a Modified Technology Acceptance Model | Chau (1996) | • No significant, direct relationship was found between ease of use and behavioral intention to use a technology. |
| Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology | Hu, Chau, Sheng, and Tam (1999a) | • The link between subjective norm and behavioral intention was not supported and negative. |
| A Test of the Extended Technology Acceptance Model for Understanding the Internet adoption Behavior of Physicians | Wiley-Patton (2002) | • Perceived ease of use did not predict the behavioral intention to use.<br>• Perceived ease of use did not have a significant effect on perceived usefulness.<br>• Image, subjective norm, and result demonstrability were not significant. |
| Test of the Technology Acceptance Model for the Internet in Pediatrics | Chismar and Wiley-Patton (2002) | • Perceived ease of use did not predict the behavioral intention to use.<br>• Perceived ease of use did not have a significant effect on perceived usefulness.<br>• Image and subjective norm were not significant. |
| Does the Extended Technology Acceptance Model Apply to Physicians | Chismar and Wiley-Patton (2003) | • Perceived ease of use did not predict the behavioral intention to use.<br>• Perceived ease of use did not have a significant effect on perceived usefulness.<br>• Image, subjective norm, and result demonstrability were not significant. |
| Understanding information technology acceptance by individual professionals: Toward an integrative view | Yi, Jackson, Park, and Probst (2006) | • Perceived ease of use was not a significant determinant of behavioral intention. |

[2] This article by Legris et al. (2003) is a critical review article of 22 TAM/Extended TAM studies and offers a meta-analysis of the empirical research done with the acceptance models.

indicate that the model does not include significant factors that are related to both social and human change processes, in addition to the innovation model.

The authors' objectives in presenting the research are "(1) to provide a critical analysis of the research methods, (2) to highlight the convergence or divergence in results, and (3) to bring out the added value of TAM in explaining system use" (Legris et al. 2003, p. 192). They accomplish these objectives by studying different segments of the model and presenting the results of a meta-analysis of the empirical research done with TAM and the Extended TAM.

Legris et al. (2003) reviewed articles that were published in major journals from 1980 to 2001. These journals were MIS Quarterly, Decision Sciences, Management Science, Journal of Management Information Systems, Information Systems Research, and Information and Management.

This review resulted in 22 articles (covering 28 measurements) being chosen for the study. The criteria used to select the papers were: (1) TAM is used in an empirical study, (2) TAM's integrity is respected, (3) the results of the research are available and complete, and (4) the research methodology is described well.

As can be verified from **Error! Reference source not found.** on page **Error! Bookmark not defined.**, the authors report that TAM has five components (Perceived Usefulness, Perceived Ease of Use, Attitude, Behavioral Intention, and Actual Use). Given these five components, TAM predicts that six of the relationships should show significance. These relationships are 1) Perceived Ease of Use to Perceived Usefulness,

2) Perceived Usefulness to Attitude, 3) Perceived Ease of Use to

**Table 5 – Where TAM Failed to Predict as Purported**

(adapted from Legris et al. 2003, p. 195)*

| Author | Perceived Ease of Use To Perceived Usefulness | Perceived Usefulness To Attitude | Perceived Ease of Use To Attitude | Perceived Usefulness To Behavioral Intention | Attitude To Behavioral Intention | Behavioral Intention To Actual Use |
|---|---|---|---|---|---|---|
| Davis et al. (1989)<br>Post training | | | **No** | | | |
| Subramanian (1994)<br>Voice mail<br>Customer dial-up | **No**<br>**No** | | | | | |
| Taylor and Todd (1995b)<br>With experience<br>No experience | | | | | **No**<br>**No** | |
| Taylor and Todd (1995a) | | | | | **No** | |
| Jackson et al. (1997) | **No** | **No** | | **No** | **No** | |
| Bajaj and Nidumolu (1998) | **No** | **Reverse** | | | | |
| Lucas & Spitler (1999) | | | | **No** | | |
| Hu et al. (1999a) | | | **No** | | | |
| Dishaw & Strong (1999) | | | | **No** | | **No** |

* Blank = The relation was found to be significant and positive, or was not measured

**No** = The relation was found to be non-significant

**Reverse** = The relation was found to be significant but negative.

Attitude, 4) Perceived Usefulness to Behavioral Intention, 5) Attitude to Behavioral Intention, and 6) Behavioral Intention to Actual Use. As can be seen in Table 5 (inspired from Legris et al. (2003)), of the 22 studies that were reviewed, nine had relationships between dyads that had no or reverse relationships. Legris et al. (2003) conclude from their meta-analysis that TAM has three limits:

1) Student involvement: Nine of the studies used students. The authors felt that the research would be better if performed in a business environment;

2) Application type: Most studies consisted of the introduction of systems development applications or office automation software. The investigators proposed that the research would benefit by examining the infusion of business process applications; and

3) Self-reported: Since most studies have not measured system use, TAM actually measures the variance in self reported use. As said by Davis (1993) and Subramanian (1994), self-reported use is not a precise measure. Legris et al. (2003) indicate that it is not only difficult to measure, self reported use should serve as a relative indicator, at best.

**Table 6 – Relations that Support/Contradict TAM of the 22 Articles Reviewed by Legris et al. 2003)**

(adapted from Legris et al. 2003, p. 196)

| | Perceived Ease of Use To Perceived Usefulness | Perceived Usefulness To Attitude | Perceived Ease of Use To Attitude | Perceived Usefulness To Behavioral Intention | Attitude To Behavioral Intention | Behavioral Intention To Actual Use |
|---|---|---|---|---|---|---|
| **Positive Relation (support)** | 21 | 12 | 10 | 16 | 7 | 10 |
| **Non-significant Relation (contradict)** | 5 | 1 | 3 | 3 | 4 | 1 |
| **Negative Relation (contradict)** | 0 | 1 | 0 | 0 | 0 | 0 |
| **% Non-significant or Negative Relation (contradict)** | **19%** | **14%** | **23%** | **16%** | **36%** | **9%** |

In summary, as can be seen in Table 6, of the six relationships that TAM purports should be significant, there are a great percentage of the relationships that were measured by the reviewed articles that show non-significance or a negative relationship. Additionally, the table shows that of the reviewed articles, the relationships that TAM purports should occur, up to 36 percent (i.e., Attitude to Behavioral Intention) show non-significant, or are negative.

### 2.3.2. Chau (1996)

According to Chau (1996), the information systems literature suggests that there are two types of perceived usefulness. These two types are 1) near-term usefulness and 2) long-term usefulness. Using data collected from 285 clerical/administrative staff in a large organization, Chau tested a modified TAM model with the two perceived usefulness variables. The results of the study show that although perceived short-term usefulness had the most significant effect on a user's behavioral intention to use a technology, perceived long-term usefulness also had a positive impact. He also concluded, contrary to the Extended TAM prediction, that there was not a significant direct relationship between ease of use and the behavioral intention to use a technology.

### 2.3.3. Hu, Chau, Sheng, and Tam (1999a)

Hu, Chau, Sheng, and Tam (1999a) use the Theory of Planned Behavior to study the acceptance of technology by physicians who practiced in public tertiary hospitals in Hong Kong. The authors' purpose was to contribute to the development and management

of telemedicine by researching physician technology acceptance using a well-researched theory. Using a user-reported/self-assessment approach to collect data, the authors analyzed 421 questionnaires. The result was that $R^2 = 0.37$ for the behavioral intention to use technology, indicating that together, attitude, subjective norm, and perceived behavioral control, account for 37 percent of the variance in intention. They also found that the hypothesized link from subjective norm to intention was not supported, and showed a negative effect – which is contrary to that predicted by the Theory of Planned Behavior. The findings of the study suggested that there was a potential limitation of the theory's predictive power of physicians' technology acceptance.

### 2.3.4. Chau and Hu (2002a)

Chau and Hu (2002a) studied technology acceptance by individual professionals by looking at physicians' decision to accept telemedicine technology. The authors developed a generic research framework which provided the necessary foundation for a telemedicine technology acceptance research model. The model was empirically tested using data collected from over 400 physicians who practiced in Hong Kong public tertiary hospitals. The results of the study suggest that individual professionals may have a subtle difference in their technology acceptance decision-making as compared with business managers in business settings and end users. The authors report that specifically, physicians appear pragmatic and base their acceptance decisions on the perceived usefulness of technology rather than on the technology's ease of use. Additionally, when deciding on the use or non-use of technology, physicians were concerned about the

compatibility of technology with their practices and were concerned less with controlling technology operations, and place little weight on peers' opinions on whether to use a technology or not.

The result of this study was a modified framework from the original framework developed. The modified framework was a hierarchical, three-layered structure with the implementation context on the outermost layer, the technological context residing in the middle layer, and the individual context at the inner core.

### 2.3.5. Chau and Hu (2002b)

Following a theory comparison approach, Chau and Hu (2002b) compare the original TAM, the Theory of Planned Behavior, and a model integrating the two models, to explain technology acceptance decisions by physicians. Telemedicine was used as the technology instantiation. They discovered that TAM was more applicable than the Theory of Planned Behavior for examining technology acceptance by professionals, and the combined model, while more closely depicting physicians' technology, "may not provide significant additional explanatory power" (Chau et al. 2002b, p. 297). This discovery was based on more than 400 physician responses. TAM and the Theory of Planned Behavior were evaluated in terms of explanatory power, overall fit, and their causal links. They also discovered that instruments developed and repeatedly tested in previous studies that involved business managers and conventional end-users may not be valid in professional environments.

### 2.3.6. Chismar and Wiley-Patton (2002; 2003); Wiley-Patton (2002)

Chismar and Wiley-Patton (2002; 2003) and Wiley-Patton (2002) suggest that while there has been an increased recognition of the internet and information technology to pediatric care, adoption of these technologies has been slow. Chismar and Wiley-Patton tested the Extended TAM by administering a modified instrument (changed for a physician's environment) to pediatricians in Hawaii. The investigation specifically looked at the adoption of the internet and pediatric internet-based health applications.

Consistent with prior research, perceived usefulness was a strong determinant of the behavioral intention to use ($\beta$ = .666, $p$ < .001). While perceived usefulness had a significant effect on the behavioral intention to use, subjective norm and perceived ease of use did not. Fifty-four percent of the variance of pediatricians' usage intention was explained by perceived ease of use, perceived usefulness, and subjective norm. Subjective norm, image, and perceived ease of use were not significant. Job relevance and results demonstrability were the factors that determined perceived usefulness. At a $p$ < 0.05 level, subjective norm, image, and output quality were not significant. Additionally, perceived ease of use was not significant which is consistent with Hu et al.'s (1999a) study of physicians. Two of the three cognitive instrumental determinants of perceived usefulness, namely result demonstrability and job relevance, that are theorized in the Extended TAM, were significant. The perceived ease of use construct was measured and the result was contrary to the Extended TAM's prediction as it did not have a significant effect on the behavioral intention to use or perceived usefulness.

### 2.3.7. Yi, Jackson, Park, and Probst (2006)

Yi, Jackson, Park, and Probst (2006) built upon and integrated three theoretical models: TAM, the Theory of Planned Behavior, and the Innovation Diffusion Theory. From this integration, they developed a more unified, coherent model and tested the resultant model with health care professionals using the PDA as the technology instantiation. Fourteen of the sixteen hypotheses were supported. These authors collected data from 222 United States physicians and the model explained 57 percent of the physicians' intention to accept an innovation with a good model fit (all recommended fit criteria met except Goodness of Fit (GFI); with Chi-squared ($X^2$) = 1.97 – recommended value is $X^2 \leq 3.00$). Perceived usefulness was the most significant determinant of physicians' intention to adopt a technology. Also, consistent with other studies in the health care field, perceived ease of use was not a significant determinant of behavioral intention. In contrast to Chau and Hu (2002a; 2002b; 2001), Yi et al. found a significant effect of perceived ease of use on perceived usefulness. Yi et al. also found that both subjective norm and perceived behavioral control had significant effects on behavioral intention to use. Contrarily, Chau and Hu (2002a; 2002b; 2001) found that subjective norm had a non-significant effect and perceived behavioral control had a significant effect on behavioral intention.

## 2.4. Summary of Literature

Our research is built from the behavioral literature, the health care literature, and the recent PDA health care literature. The review of this array of literature is important

because it forms a basis to assist in rebuilding technology acceptance theories that can more accurately predict physicians' behavioral intention to use technology. It was also necessary to review the health care articles that refute or contradict technology acceptance literature because the rebuilt theory should be shown to answer ease-of-use confirmations and contradictions.

Even though the current technology acceptance models have failed to accurately predict health care technology acceptance, absent from the literature is research that uses different methodological approaches to try to explain this void. This research, being a positivist qualitative study, will begin to fill this gap. Using this different methodological approach, health care technology acceptance will be viewed in an entirely different way. This in turn will better explain physicians' behavioral intention to use technology.

# CHAPTER 3
# METHODOLOGY

This study uses a positivist case study research approach, as specified by Yin (1994), and uses the "natural science model" of empirical inquiry using the rules of hypothetico-deductive logic, as presented by Lee (1989a; 1989b), to confirm propositions that are discovered. Lee (1989a) purports that organizational case studies can be completed using hypothetico-deductive logic to satisfy the rigorous standards of the natural science method. Using this form of logic, new theoretical propositions are investigated (Allen S. Lee, personal communication, June 8, 2006).

The codification of the data that leads to the theoretical propositions uses coding techniques that are similar to Strauss and Corbin's (1990; 1997) open and axial coding. These propositions satisfy the positivist requirements of falsifiability, logical consistency, relative predictive power, and survival (Lee, 1991, pp. 343-344 and pp. 346-347).

In developing the methodology, it was necessary to reflect on our research goal and research questions. This was done so that the methodology designed would be more capable in answering our questions and ultimately obtain the goal of this research. The goal and research questions as presented earlier are:

Goal

To present an improved technology acceptance theory that better explains the determinants of physicians' behavioral intention to use technology, and

Research Questions

1) What is it about physicians and their environments that cause TAM's prediction that *perceived ease of use* influences *perceived usefulness* to be incorrect?
2) What, if any, characteristics of physicians and their environments contribute to physicians' use and non-use of PDAs?

## 3.1. Research Model

### 3.1.1. Hypothetico-Deductive Logic

Hypothetico-deductive logic is a tool that scientists have used to assist in explaining phenomena (e.g., Kanter 1977; Markus 1983; Nardulli 1978; Nardulli 1979) This method follows the natural science model of social science and can be used as a basis for research that cannot be conducted in a laboratory setting (Lee 1989a; Lee 1989b; Lee 1991). The rules of hypothetico-deductive logic are appropriate for testing theories in a deductive sequence (Lee 1989b). In this dissertation the theories that are presented are not tested; however, hypothetico-deductive logic is used to ensure that the resultant propositions are corroborated with the data that is extracted from the physician interviews.

Relying on the validity of a particular theory, hypothetico-deductive logic purports that all of the underlying theoretical propositions included in the theory are true. This logic assumes that the theory is true and questions the truthfulness of the predictions. If it is determined that the predictions are true, the assumption is (at least in this specific case) that the theory is not false. If it is determined that the predictions are false, there may be a problem with the theory, measurement, observation, instrumentation, boundary and initial conditions, or the auxiliary assumptions (Scheiderer 1999).

There are a few different scientific philosophies that are used to perform research. The two most widely used philosophies are positivism and interpretivism. Case studies can be positivist or interpretive. In conducting this research, the positivist scientific method known as the natural science model of social science research (Lee 1989a; Lee 1989b) is being used. As reported by Lee (1989a, p. 122), the natural science model is about (1) how to manipulate theoretical propositions, (2) using the rules of hypothetico-deductive logic, so that the theoretical propositions (3) satisfy the four requirements of falsifiability, logical consistency, relative predictive power, and survivability.

As stated, Lee (1989a, p. 122) indicates that the natural science model is about how to manage theoretical propositions. The propositions are referred to as theoretical because they involve "entities, phenomena or relationships which are not publicly observable or which cannot be seen directly" (Lee 1989b, p. 12). Examples of these unobservable phenomena that the research can only theorize exist are protons, neutrons,

and electrons in physics, and black holes in astronomy (Copi et al. 1986 as cited in Lee 1991).

Since the theoretical propositions refer to unobservable entities, phenomena, or relationships, the natural science model prescribes what is known as hypothetico-deductive logic in order to determine if the theory is true. In hypothetico-deductive logic, as is illustrated in Table 7, box 1, the model calls for applying the theoretical propositions to data or initial conditions of an actual situation (box 2 of Table 7). As a prediction of the theory's propositions being true, deductions are made about things that would be observable (box 3). If what the theory hypothesizes to occur (box 4) is observed, the theoretical propositions (box 1) and additionally all the unobservable things to which they refer, would be considered confirmed (Lee 1989a, pp. 122-123).

"Hypotheses" can be defined differently. Hypotheses can be identified as the actual theory or identified as the predictions. In this study, hypotheses are defined as predictions, as are shown in Table 7, box 3.

Hypothetico-deductive logic, involving a major premise, a minor premise, and a conclusion is a way of using the logic of the syllogism. For instance, given a theoretical proposition such as "All birds fly," an investigator would like to determine the truthfulness of this statement. Using the natural science model (right side of Table 7), the researcher would 1) apply the statement "All birds fly" (Table 7, box 5) to actual situations such as "A bird is a blue jay" (Table 7, box 6). This would result in a prediction: "A blue jay flies" (Table 7, box 7). At this point it is only left to see if the blue

**Table 7 – The Natural Science Model**
Adapted from Lee (1989a, p. 129)

| Hypothetico-Deductive Logic | The Standard Syllogism |
|---|---|
| 1. | 5. |
| Theory:<br><br>Theoretical Propositions | All birds fly |
| 2. | 6. |
| Data,<br>initial conditions | A blue jay is a bird. |
| 3. | 7. |
| Predictions, hypotheses of what should be<br>Observed | A blue jay flies. |
| 4. | 8. |
| Testing:<br>Comparison to what<br>is actually observed | Observation:<br>A blue jay is seen in the atmosphere. |

jay is seen in the air (Table 7, box 8) and this would either confirm (confirm or corroborate, but not prove) or refute the truthfulness of the statement in Table 7 box 5 (All birds fly).

When theoretical propositions are managed using hypothetico-deductive logic, four requirements are necessary. These requirements are 1) falsifiability -- a possibility exists that the theory can be proven untrue, 2) logical consistency -- the predictions that the theory produces do not contradict one another, 3) relative predictive power -- stands

equal to or surpasses other known competing theories, and 4) survival -- all attempts to show a theory falsifiable have failed (Lee, 1991, pp. 343-344 and pp. 346-347). Section 3.2.8. Assessing the Validity of a Case Study on page 95 shows how each of these requirements was tested in this research.

### 3.1.3. Yin (1994) Case Study Research Method

There are many works that are exemplars of, or guidelines for, conducting positivist case study research (e.g., Eisenhardt 1989; Kanter 1977; Lee 1989a; Lee 1989b; Markus 1983; Orlikowski et al. 1991; Yin 1994; Yin 2003). As stated, this study uses the positivist case study guidelines specified by Yin (1994) and uses the "natural science model" of empirical inquiry as presented by Lee (1989a; 1989b) . Yin (1994, p. 13) states, "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially if the boundaries between phenomenon and context are not clearly evident." This research will be qualitative and will follow a positivist case study approach that has been exemplified by investigators such as Kanter and Markus. Lee (1989a; 1989b) shows how the respective positivist case studies of Kanter and Markus satisfy the standards of the "natural science model" of scientific research.

According to Yin (1994), it is often not possible to create an experimental environment if one is trying to control behavioral events. He offers the case study approach as a tool to gather data if the environment cannot be adequately controlled.

Using the case study approach, data was gathered in physicians' environments to rebuild technology acceptance theories. In addition to Yin's assertion, Lee (1989a) states:

> The term "organizational case study" refers to (1) the intensive study of a single case, where (2) the case consists of the entire configuration of individuals, groups, and social structure in the setting of an organization, and (3) the case researcher passively observes the rich details of events in the way that they naturally unfold in their natural, organizational setting. (pp. 119-120)

### 3.1.4. Coding to Derive Propositions

Yin's (1994) method is used to guide this case study. Data were collected via semi-structure interviews and were analyzed with qsr's N6 (earlier known as NUD*IST, which is an acronym for the accurate description of Non-numerical Unstructured Data Indexing Searching and Theorizing). The qualitative researchers Strauss and Corbin (1998, p. 12), who primarily use grounded theory, purport that theory that has data as its foundation will likely enhance understanding, offer insight, and provide a meaningful guide to action.

## 3.2. Research Design

The Journal of Mobile Informatics (2005) indicates that mobile computing is the next technology frontier for health care providers. PDAs are used throughout the health care industry for such tasks as accessing medical literature, viewing pharmacopoeias, pursuing medical education, tracking patients, researching, scheduling, and e-prescribing

(Fischer et al. 2003). Additionally, data capture and retrieval using PDA technology by nurses, allied health care professionals, and physicians are improving efficiency and enhancing patient care. Current applications primarily run under the two leading PDA operating systems: PALM OS® and Windows CE®. The concept of a PDA running health care applications will be the technology focus in this case study.

### 3.2.1. Study Participants

Data were collected, using semi-structured interviews, and analyzed until meanings and concepts became clear. After the seventh interview, additional categories were not recognized in the subsequent interview. This phenomenon of not discovering additional categories is known as theoretical saturation. This is when no new substantial ideas are discovered in the data (Strauss et al. 1990; Strauss et al. 1998).

As a start, several initial study participants and backup participants were identified. The primary field of study is Virginia Commonwealth University (VCU) Student Health and VCU Health System.

The VCU Health System has approximately 7,000 staff members - from doctors, nurses, and resident medical staff to support personnel and administrators. The VCU Health System is composed of hospitals, clinics, and a medical college. The medical college is known as the VCU School of Medicine. The teaching hospital component of the VCU Health System includes a number of outpatient clinics, physicians, and a 600-physician faculty group practice. The teaching hospital has 779 licensed beds and approximately a 20% share of the Richmond, VA inpatient market. The VCU Health

System has 30,000 admissions and greater than 500,000 outpatient visits each year. The hospital's emergency department treats over 80,000 patients each year.

Also participating in the study are members of the VCU Student Health organization. The VCU Student Health organization provides health care to VCU students. Experienced staff members (including physicians, nurses, and counselors) provide diagnosis and treatment of illnesses as well as focus on prevention of illness and the promotion of health through screening, counseling, and education. They do this by offering students access to clinical services, pharmacy services, immunization services, and health information through the Office of Health Promotion. The Office of Health Promotion offers services and information such as substance abuse education and prevention, sexual assault/relationship violence prevention, nutrition, disordered eating and body image, tobacco use reduction, women's health, stress management, sexually transmitted infections, and Human Immunodeficiency Virus (HIV). These services and information are provided via counselors and a health resource library.

The primary study participants are physicians employed by the VCU Health System and the VCU Student Health organizations. The primary participants practice at the VCU Monroe Park campus or the VCU Medical campus – both in Richmond, Virginia.

Five additional physicians (identified as back-up participants) in the Richmond, Virginia vicinity were identified. The identification of these physicians as backups was necessary since the exact number of physician interviews was not determined a priori.

The back-up participants were not included in the study because new categories were not uncovered after the seventh interview.

### 3.2.2. Designing the Case Study

In completing the case study design, Yin (1994, p. 32) indicates that the design should have the components of: 1) a study's questions, 2) its propositions (if any), 3) its units of analysis, 4) the logic linking the data to the propositions, and 5) the criteria for interpreting the findings. The study questions are presented in Chapter 1 of this dissertation. Propositions were discovered as data were analyzed and synthesized. The unit of analysis was the physician, who is in an organizational setting. The logic linking the data to the propositions and the criteria for interpreting the findings is based on the natural science model of social science research using hypothetico-deductive logic.

Yin (1994) states that the research design should be based on the "logical sequence that connects the empirical data to a study's initial research questions and ultimately to its conclusions" (2003, p. 20). However, subsequent to designing the case study, is preparing for data collection, collecting the data, analyzing the data, and presenting the results of the study. This research follows the steps that are identified by Yin (1994).

### 3.2.3. Preparing for Data Collection

After the case study design was complete, preparing for data collection was necessary. A major part of this preparation was ensuring that the researcher was

sufficiently skilled to conduct the research. Yin (1994, p. 54) wrote, "...many people incorrectly believe they are sufficiently skilled to do case studies because they think the method is easy to use. In fact, case study research is among the hardest types of research to do." Direction and guidance from knowledgeable qualitative researchers was sought throughout the case study to ensure that the needed skills were obtained to complete the study.

While researching skills are extremely important, it was equally important to develop a case study protocol (contains the instrument and the procedures and general rules that should be followed in using the instrument).

### 3.2.4. Semi-Structured Instrument Development

An instrument was developed for the semi-structured interviews. This instrument, called the Physician's TAM Instrument is in Appendix D on page 172. The semi-structured instrument questions were derived from the questions that Venkatesh and Davis (2000) used in the Extended TAM as shown in Table 8. A sample of several of the questions in the PTAM instrument is shown in Table 9. While the questions in the Extended TAM and the PTAM questionnaires are similar, the latter instrument poses follow-up questions that ask the physicians probing, open ended questions such as "Why or why not?" This allowed the physicians to elaborate on yes and no answers and provide additional information that assisted in discovering why TAM has failed to accurately predict the behavioral intention to use technology in health care environments.

**Table 8 – Instrument Questions used in the Extended TAM**

| |
|---|
| **Perceived Usefulness**<br>• Using the new system will improve the quality of the work that I do<br>• Using the new system will give me more control over my work<br>• Using the new system will allow me to accomplish tasks more easily<br>• The new system will support critical aspects of my job<br>• Using the new system will increase productivity<br>• Using the new system will increase my job performance<br>• Using the new system will allow me to accomplish more work than would otherwise be possible<br>• The new system will enhance my effectiveness on the job |
| **Perceived Ease of Use**<br>• I think it will be easy to get the new system to do what I want it to do<br>• I think the new system will be easy to use<br>• My interaction with the new system will be clear and understandable<br>• The new system will be flexible to interact with<br>• Learning the new system will be easy for me<br>• It will be easy for me to become skillful at using the new system<br>• Overall, I think the new system will be easy to use |
| **Behavioral intention to use the system**<br>• I intend to use the system in the next <n> months.<br>• I predict I would use the system in the next <n> months.<br>• I plan to use the system in the next <n> months |

Additionally, these data assisted in discovering why in health care environments the relationship between perceived ease of use and perceived usefulness failed to predict the relationships as the Extended TAM purports should occur.

Other questions for the Physician's TAM instrument were developed to assist in understanding physicians' behavioral intention to use the PDA in their health care practice and to answer the research questions presented in Chapter 1 on page 15.

A semi-structured instrument, as stated, contains open-ended questions. To increase construct validity, the instrument questions were presented to three physicians.

**Table 9 – Sample Physician's TAM Instrument Questions**

| |
|---|
| Do you find the PDA easy to use?<br>Why or Why not? |
| What are the characteristics of the PDA that you enjoy most?<br>Environmental, training, PDA characteristics, results of using a PDA. |
| What changes to the PDA would make the PDA more useful? |
| Do you believe that using a PDA is confusing?<br>Why or why not? |
| Do you believe that using a PDA is frustrating?<br>Why or why not? |
| Do you believe that using a PDA is cumbersome?<br>Why or why not? |
| Do you believe that interacting with your PDA is clear and understandable?<br>Why or why not? |
| Do you believe that you find it easy to get your PDA to do what you want it to do?<br>Why or why not? |
| Do you believe that interacting with the PDA requires a lot of your mental effort?<br>Why or why not? |
| Do you always try to use your PDA to do a task whenever it has a feature to help you perform it?<br>Why or why not? |
| Do you always try to use your PDA in as many cases / occasions as possible?<br>Why or why not? |

These physicians were asked to assess the instrument's ability to gather data that would contribute to answering the research questions. Similarly, feedback was sought from VCU Information Systems Ph.D. students and a professor skilled in qualitative research.

These individuals were also asked to assess the instrument. Items were added, deleted and changed based on the feedback from the physician, the students, and the professor.

### 3.2.5. Data Collection

After preparation, the evidence was collected. As stated, data for this study came from physician semi-structured interviews.

*3.2.5.1. Face-to-face semi-structured interviews.* Schartzman (1993, p. 58-63), though an ethnographer, nonetheless provides guidelines that can also be used in conducting field study interviews. Her guidelines specify that participants should be allowed to talk without interruption, so the interviewer does not attempt to translate the respondent's information into his/her own interpretation. However, follow-up questions were provided to responses, to assist in clarifying and obtain *richer* responses from the participants. This process as suggested by Schwartzman was used when conducting the semi-structured interviews. The interviews were digitally recorded and manually transcribed. Following the meetings, within twelve hours, a summary response was written to capture the interviewer's reaction to the session.

### 3.2.6. Data Analysis

While the above procedures were used to collect the evidence, analysis occurred simultaneously. This case study used the software application by qsr called N6 which assisted in data analysis. N6 is the sixth version of NUD*IST (Non-numeric Unstructured Data Indexing, Searching and Theorizing) and is widely used by qualitative researchers

to assist in interpreting and analyzing data. This software was used to assist in the codification and analysis of the qualitative data obtained during the study. The instrument, the semi-structured interviews, the participant pre-interview questionnaire, and the interviewer summaries were input into N6 for data manipulation and analysis. Output from N6 assisted with the codification of data and the analysis.

*3.2.6.1. Codification of Data.* A major part of analyzing the captured data was the codification process. Coding is not a rigid process -- it is free flowing and requires flexibility and creativity on the part of the researcher. "Analysts move quickly back and forth between types of coding, using analytic techniques and procedures freely and in response to the analytic task before analysts" (Strauss and Corbin, 1998, p. 58). Although N6 greatly assisted with the codification process, it is still important to understand the components of the processes that were performed.

To facilitate coding, there are several tools that qualitative researchers Strauss and Corbin purport can be elicited. Strauss and Corbin (1998, p. 89) indicated that the purposes of using analytic tools are to:

- Steer a researcher's thinking away from the confines of both the technical literature and personal experience.
- Avoid standard ways of thinking about phenomena.
- Stimulate the inductive process.
- Focus on what is in the data, and do not take anything for granted.
- Allow for clarification or debunking of assumptions made by those being studied.

- Listen to what people are saying and doing.
- Avoid rushing past "diamonds in the rough" when examining data.
- Force the asking of questions and the giving of provisional answers.
- Allow fruitful labeling of concepts, although provisionally.
- Discover properties and dimensions of categories.

Three processes that overlapped were involved in the analysis from which coding procedures were derived. These processes are open coding (Strauss et al. 1998, p. 98), where data is broken open to identify relevant categories; axial coding (p. 98), where categories are refined, developed and related; and completion coding, where propositions are determined.

This research uses techniques similar to open and axial coding to develop categories and uses completion coding to discover theoretical propositions. Each of these techniques is shown below.

*Open Coding*

Open coding is "the analytic process through which concepts are identified and their properties and dimensions are discovered in data" (Strauss & Corbin, 1998, p. 101). Open coding leads to conceptualizing. This entails grouping similar items according to some defined properties. Conceptualizing also includes the naming of items that represent that common link. Once categorized, the specification of properties occurs. In addition, it is important to show how the concepts (categories) vary dimensionally along those properties (Strauss & Corbin, 1998, p. 121). Alas, patterns that become the foundation for, and the start of, theory building should appear.

*Axial Coding*

While open coding assists in identifying properties and their dimensions, axial coding further breaks down these categories. Axial coding is "the process of relating categories to their subcategories, termed 'axial' because coding occurs around the axis of a category, linking categories at the level of properties and dimensions" (Strauss & Corbin, 1998, p. 123). The process of axial coding is done systematically to relate and develop categories. This coding scheme will allow for the addition of depth and structure to the categories obtained during open coding. This process continues to build theory.

*Completion Coding*

During open coding, the analyst is concerned with developing categories and properties and the dimension of the properties, and axial coding categories are systematically developed and linked with summary categories. Completion coding is used to discover phenomenon in the data that take the form of plausible theoretical propositions.

In this process of analysis, propositions emerged. Rew, Bechtel, and Sapp (1993), and other qualitative researchers believe that one's self should be used as an instrument in data collection. As stated, theory building is one of emergence. Strauss and Corbin (1998, p. 33) state "… we believe that unless the researcher is building on or continuing with his or her own previous studies, the researcher will not be able to enter into the project with a set of pre-established concepts or with a well-structured design." Knowledge of TAM and physicians' environments is instrumental in developing hypotheses that can be

eventually tested. The design, similar to the concepts, emerged during the research process.

Data analysis was the beginning of the natural emerging of relationships and concepts that occurred through qualitative analysis. This information was used to determine where and how to gather additional data and this further added to the hypotheses.

While the coding procedures used in this research used techniques similar to those used in grounded theory, this is not a grounded theory study. It is a positivist case study that is based on Yin's (1994) methodology.

### 3.2.7. Case Study Report

Yin's (1994, p. 127) case study methodology requires the preparation of the case study report. This dissertation serves as the case study report. At completion of this report, the data analysis results, synthesis of findings, and conclusion; Chapters 4, 5, and 6; were reviewed by one of the study participants.

### 3.2.8. Assessing the Validity of a Case Study

Even though it was very important to follow the procedures as indicated in the previous section, there are criteria that must exist for the theory to be valid. These requirements are:

1) Construct validity,

2) Internal validity,

3) External validity,

4) Reliability,

5) Falsifiability,

6) Logical consistency,

7) Relative predictive power,

8) Survivability, and

9) Comparative validity

The first four requirements above (1 – 4) are adapted from Yin (1994) and the next four criteria (5 – 8) are from Lee (1989a; 1989b; 1991). Additionally, because this study is motivated by TAM studies where the propositions were refuted, included in this section is a definition of *comparative validity* (9) as conceptualized by Allen S. Lee (personal communication, April 28, 2006).

The following describes each validity criterion. In Chapter 5 the activities that were performed to ensure this case study demonstrates an acceptable level of quality is presented.

*3.2.8.1. Construct Validity.* In testing construct validity, Yin (1994) states that proponents of the case study method often point out "that a case study investigator fails to develop a sufficiently operational set of measures and that 'subjective' judgments are used to collect the data." Yin also says that testing a case study's construct validity is often problematic (p. 34). However, to meet the test, Yin indicates that to increase construct validity one could use multiple sources of evidence (converging on the same set of facts or findings), and/or establish a chain of evidence (link between the questions

asked, the data collected, and the conclusion drawn, and/or have the draft case study report reviewed by key informants and participants) (pp. 34 – 35).

While evidence may come from numerous sources, Yin (1994) focuses his discussion on the evidence that comes from documents, archival records, interviews, direct observation, participant observation, and physical artifacts (p. 79). Having one data source or another is not as important as having multiple sources in the case study research (pp. 90 – 91). Even more importantly is ensuring that discoveries are based on the convergence of information from these different sources (p. 92). Yin asserts, "Any finding or conclusion in a case study is likely to be much more convincing and accurate if it is based on several different sources of information, following a corroboratory mode" (p. 92).

In addition to obtaining multiple sources of evidence, Yin (1994) states that maintaining a chain of evidence will contribute to not only a study's construct validity but also its reliability (described on page 99). Maintaining a chain of evidence is resident when an external examiner of the case study report can follow the research from beginning to end. This continuum is from evidence gathering, captured from the initial research question(s), to the case study findings (Yin 1994, p. 98). Additionally, the external examiner should be able to traverse the study in reverse (i.e., going from the conclusion to the initial research questions).

According to Yin (1994), draft review occurs while the researcher comprises the final report. Not only should peers review the report, but also key informants and study participants should review the report. The purpose of this review process is to verify the

facts as presented in the case (p. 144). The reviewers may not agree with the researcher's interpretations and conclusions; however, most important is that the reviewers agree with the facts as presented. Yin states, "From a methodological viewpoint, the corrections made through this process will enhance the accuracy of the case study, hence increasing the *construct validity* of the study" (p. 146).

*3.2.8.2. Internal Validity.* Internal validity pertains to only causal (or explanatory) case studies, which is whether certain conditions lead to other conditions (Yin, p. 33). Therefore, plainly, internal validity is asking the question does x lead to y. Yin also purports that a case study's internal validity extends to the larger problem of making inferences. In case studies, inferences are made every time an event is not directly observable (p. 35).

The specific activities that lead to acceptable internal validity are difficult to identify in any form of research – especially case study research. Yin (1994) says that one way to increase internal validity is to use explanation building (p. 110). He says that stipulating causal links equates to explaining a phenomenon. This research uses explanation building.

*3.2.8.3. External Validity.* While internal validity looks at how the construct matches to the intended result, external validity looks at the generalizability of one's findings beyond the immediate case study. Lee and Baskerville (2003) indicate that generalizing case study research theories is not any more difficult than generalizing theory that is derived quantitatively. This is because contrary to popular belief, Lee and Baskerville (2003, p. 226) state that in quantitative research, "An increase in sample size

is beneficial, but the benefits take the form of improved *reliability of the sampling procedure*, rather than improved *generalizability of a sample to its population.*"

Yin states that a case study is externally valid if it is generalizable beyond the immediate case study. He states that external validity is obtained by "establishing the domain to which a study's findings can be generalized," and he asserts that the externally valid criterion is most easily satisfied by conducting multiple case studies (Yin, pp 33 and 35). He does not however say that multiple case studies need to be conducted for findings to be externally valid. With case studies, this generalization is analytical – not statistical as it is in quantitative forms of research. Yin asserts that case studies should aim for analytical generalization. In analytical generalization, the researcher's goal is to generalize a specific set of results to some broader theory (Yin 1994, p.36). Not only is it necessary for one's study to be generalizable, it must be repeatable. Reliability coincides with repeatability.

*3.2.8.4. Reliability.* If an investigator were to come behind another research and attempt to replicate the study, the same results should be obtained (Yin, p. 36). Therefore, the goal of reliability is to minimize biases and errors in a case study.

The possibility of conducting the case study exactly as conducted is impossible because each researcher comes with a different level of sensitivity and knowledge. However, Yin (1994) states that tactics to ensure increased reliability include documenting the process thoroughly and developing a case study database. Yin asserts that reliability is obtained easily if the researcher conducts the study as if someone is continuously looking over her shoulder (p. 37). One can also increase reliability by using

a case study protocol (p. 63). This case study has a protocol and a database, and therefore satisfies Yin's criterion of reliability.

*3.2.8.5. Falsifiability.* The first of Lee's (1989a; 1989b; 1991) requirements is falsifiability. There needs to be a possibility that the theory can be falsified. As indicated, the specific relationship that this research investigates is the relationship between perceived ease of use and perceived usefulness. TAM purports that there is a relationship between these two variables; however, studies have shown that in health care environments, the relationship has often failed to exist. The resultant theory would be refuted if physicians consistently indicated that there is a relationship between the two aforementioned variables by indicating that they believe that a PDA's ease of use determines whether a PDA is useful in a physician's environment.

*3.2.8.6. Logical consistency.* The propositions that the theory produces can not contradict one another. For instance, the resultant theory can not suggest that there is not a relationship between perceived ease of use and perceived usefulness and also say that perceived ease of use is an antecedent of perceived usefulness.

*3.2.8.7. Relative Predictive Power.* The resultant theory must be at least equal if not better than other theories that attempt to explain physicians' intention to use technology. As stated, TAM has failed to accurately predict the use of technology in health care environments. The resultant theory must explain a physicians' use of a PDA better than other theories such as TAM and the Extended TAM.

*3.2.8.8. Survivability.* The resultant theory must stand up against attempts of falsification. While this study is a single case study, attempts to satisfy this requirement

must be done in future research. The resultant theory can be applied to other health care organizations and determine if PTAM is applicable.

*3.2.8.9. Comparative validity.* Comparative validity shows how the new theory can improve previous application(s) of theory. Legris et al.'s (2003) critical review reveals numerous studies where TAM failed to predict the behavioral intention to use technology. In order to satisfy the comparative validity criterion, the resultant theory was applied to previous health care studies where TAM's application failed to predict technology use. This study specifically examines the perceived ease of use variable; therefore, the studies that PTAM has been applied to validate its predictive ability are: Chau (1996), Chau and Hu (2002a), Wiley-Patton (2002), Chismar and Wiley-Patton (2002; 2003), and Yi, Jackson, Park, and Probst (2006).

## 3.3. Methodology Summary

Using the methodology as presented in this chapter, the data analysis occurred and took the form of open, axial, and completion coding. The results of this codification process resulted in the development and presentation of several propositions as presented in Chapter 4.

# CHAPTER 4
# DATA ANALYSIS RESULTS

## 4.1. Introduction

The results of the data analysis are presented in this chapter. With the assistance from N6, the qualitative analysis software tool developed by qsr, it was possible to code the interviews, analyze the data, and discover phenomena that were garnered from the data analysis. First is a brief description of the case study which includes an overview of the organization studied and a description of the participants who took part in the study. Using techniques similar to open and axial coding as presented by Strauss and Corbin (1990; 1998), N6 assists in the analysis and categorization of the interview data. The final analysis that occurred is completion coding and is based on a line by line analysis of the interview transcriptions which leads to several suggested theoretical propositions about physicians' intention to use a PDA. Each coding technique's (open, axial, and completion) description is followed by a detailed example. These examples are presented to assist the reader to better understand the process that was followed to ascertain the categories and plausible propositions that are presented in this chapter.

## 4.2. Case Study

The field of study is Virginia Commonwealth University's (VCU) Health System and VCU's Student Health departments. Eight doctors, who hold various positions within

the VCU Health System or the Student Health organization, took part in the study. While the roles of the physicians vary, each doctor is engaged in treating patients.

### 4.2.1. Case Study Document Repository

Figure 9 is a snapshot of the Case Study Document Repository. The document repository contains several items of which a subset forms what Yin (2003) refers to as the case study database. Yin (2003, p. 102) states, "...every case study project should strive to develop a formal, presentable database, so that in principle, other investigators can review the evidence directly and not be limited to the written case study reports. In this manner, a case study database increases markedly the *reliability* of the entire case study."

The case study document repository in this research project contains several sections as seen in Figure 9. The title of the case study project shown in the top title bar is PTAM. The "Document Explorer" shows the contents of the project which include each transcript from the eight interviews, the case study notes (Case Study Notes), as well as the interview instrument (Instrument), the letter that was sent to the interviewees (Mktg Letter), and the Research Synopsis (Synopsis). The research synopsis (which contains the rules and process of the interviews) and the instrument collectively, constitute the research protocol.

The example that is highlighted in the Document Explorer is GBlue-Interview. Once highlighted, more information about the interview is given on the right side of the Document Explorer. As can be seen, the Interview GBlue-Interview is Interviewee 403 –

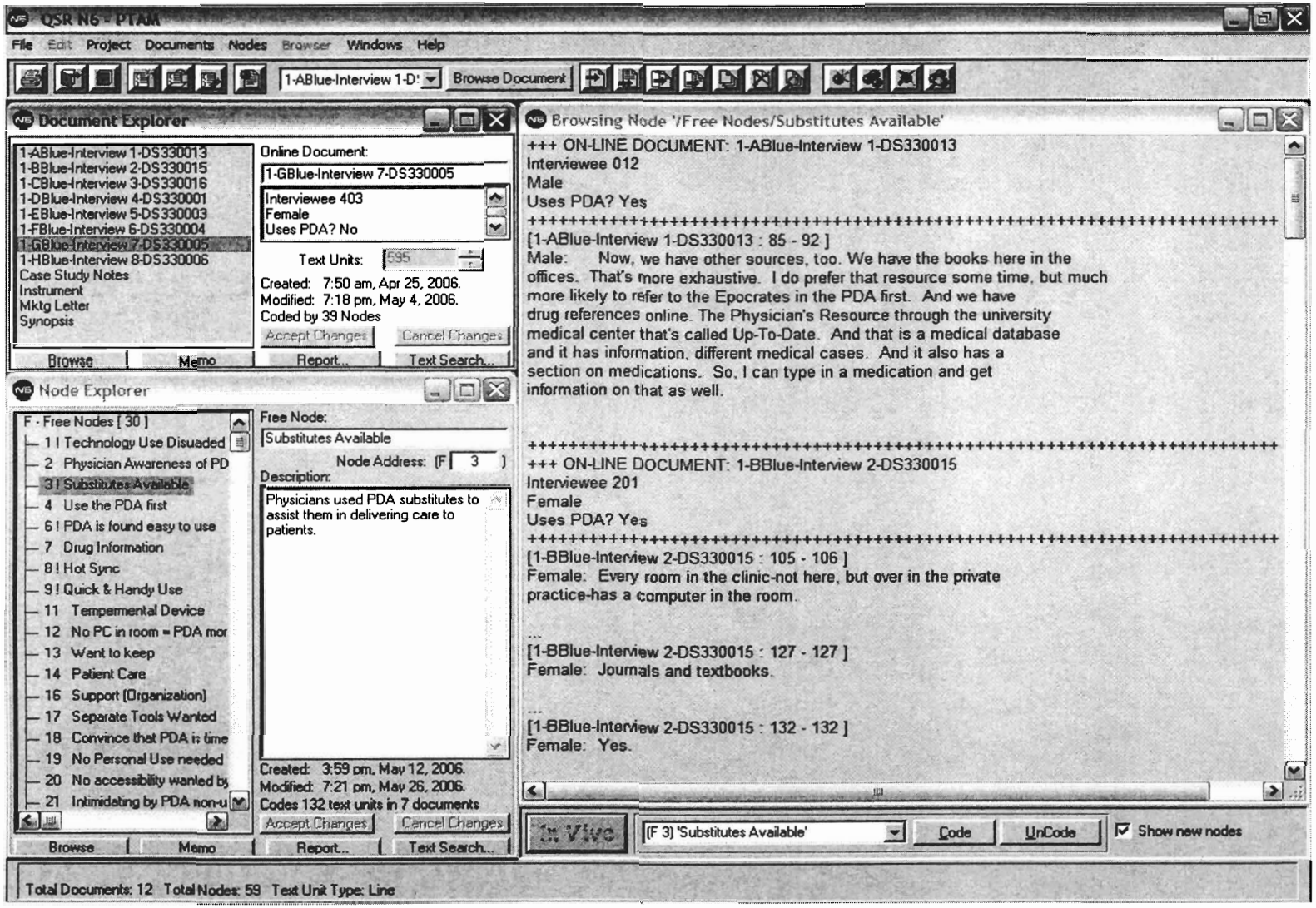



**Figure 9 – Case Study Document Repository**

a female who currently does not use a PDA. The transcript was originally created on April 25, 2006 and was last updated on May 4, 2006. Within the GBlue-Interview document there are 39 nodes (categories) that have been recognized and coded. Not shown in the example is the actual transcript; however, this is obtainable by highlighting the desired document and clicking "Browse," which is located at the bottom left of the Document Explorer.

The Node Explorer shows a list of each of the categories that have been recognized and is in the section below the Document Explorer. Even though the category may be listed in the Node Explorer, there still may not be any phrases in the interviews that are "connected" to the category. The links are the connection from the category to phrases in one or more of the documents in the Document Explorer. The example shows that 30 free nodes (connections) have been identified. Highlighted is the node called "Substitutes Available." The right side of the Node Explorer is a more detailed description of the Substitutes Available category. This is Node 3 and the description is: "Physicians used PDA substitutes to assist them in delivering care to patients." The node was created on May 12, 2006 and last modified on May 26, 2006. The description tells us that 132 text lines of the "Substitutes Available" category are found in seven documents.

On the right side of the document repository is the Browsing Node panel. The "Substitutes Available" category was highlighted and the browse button at the bottom of the Node Explorer was pressed. This presents the phrases that have been identified in each of the seven documents linked to "Substitutes Available." The first phrase is from

the "ABlue-Interview 1" transcript (also identified as the interview with Interviewee 012). The browser repeats the information about this interviewee (Gender – M, and PDA Use? Yes). Below this identifying information is the exact text from the manuscript that pertains to the "Substitutes Available" category which is contained on text lines 85 to 92 of the manuscript.

> **Male:** Now, we have other sources, too. We have the books here in the offices. That's more exhaustive. I do prefer that resource some time, but much more likely to refer to the Epocrates in the PDA first. And we have drug references online. The Physician's Resource through the university medical center that's called Up-To-Date. And that is a medical database and it has information, different medical cases. And it also has a section on medications. So, I can type in a medication and get information on that as well.

Below the text from Interviewee 012's interview is information pertaining to "BBlue-Interview 2." Shown are three of the passages from the manuscript from Interviewee 201. This pattern is repeated for the remaining five interview scripts.

### 4.2.2. Interview Overview

In Table 10 a descriptive overview of the physicians who participated in the interview process is presented. The eight one-on-one semi-structured interviews were conducted between March 27, 2006 and April 11, 2006. Prior to each participant's specific interview, each was told that the interview would take less than 45 minutes,

**Table 10 – Interviewed Physician Information**

| Inter-viewee | Gender | Year of Birth | Medical School Attended | Board Certification(s) | Currently Use PDA? | Previously Used PDA? | Self Reported Computer Skills Level | Researcher Skill Level Assessment | Inter-view Length (min: sec) |
|---|---|---|---|---|---|---|---|---|---|
| A | Male | 1957 | Boston University | Family Medicine | Yes | Not applicable | Medium | High | 31:26 |
| B | Female | 1959 | Virginia Common-wealth University | Internal Medicine | Yes | Not applicable | Medium | Medium | 16:24 |
| C | Male | 1970 | Meharry Medical College | Obstetrics / Gynecology | Yes | Not applicable | Medium | High | 32:04 |
| D | Male | 1946 | New York University School of Medicine | Internal Medicine Endocrinology and Metabolism | No | No | Medium | Medium-Low | 21:36 |
| E | Female | 1963 | Columbia University | Family Medicine | Yes | Not applicable | Medium | Medium | 18:55 |
| F | Female | 1961 | Virginia Common-wealth University | Internal Medicine Nephrology Clinical Pharmacology | No | Yes | Medium | Medium | 17:25 |
| G | Female | 1966 | Virginia Common-wealth University | Internal Medicine | No | Yes | Medium | Low | 34:03 |
| H | Female | 1975 | Creighton University | Internal Medicine | No | No | Medium | Medium | 26:39 |

even though the expected length of each interview was between 20 to 30 minutes, Table 10 shows that the interview lengths varied from as short as 16 minutes 24 seconds to as long as 34 minutes 3 seconds.

### 4.2.3. Subject Description

Three males and five females participated in the study. Of these eight participants, there is a 50/50 split of those who do and do not use a PDA in their medical practice. Of the four who currently do not use a PDA, two participants previously used a hand-held device.

Six of the eight study participants have their medical degrees from institutions in states on the eastern seaboard. The remaining two received their medical degrees in Tennessee (Meharry Medical College) and Nebraska (Creighton University). The physicians' board certifications vary; however, the majority of the doctors are certified by the International Board of Internal Medicine. Other certifications are Family Medicine, Obstetrics and Gynecology, Endocrinology and Metabolism, Nephrology, and Clinical Pharmacology. All of the physicians reported a medium level of computer skill and acumen.

### 4.3. Coding

As stated, the software N6 was used to assist in analyzing interview manuscripts, and was the impetus for the determination of propositions that coincided with the interview data. The interviews were digitally recorded and professionally transcribed by a third party. The full scripts of each interview can be found in Appendix G beginning on page 197. Once transcribed, the text was imported into the software to facilitate the analysis process. Each of the eight files, one representing each interview, was edited to include data from the pre-interview information sheet that each physician filled out at the time of their interview (See Appendix C, page 170).

Based on prior knowledge of technology acceptance, reviewing the research questions for this study, and from sitting through eight interviews, the first version of categories were determined. The research questions as presented in Chapter 1, Page 15 are: 1) What is it about physicians and their environments that cause TAM's prediction

that *perceived ease of use* influences *perceived usefulness* to be incorrect? and 2) What, if any, characteristics of physicians and their environments contribute to physicians' use and non-use of PDAs? This information was used to determine the preliminary categories. These categories are presented in column 1 of Table 11 shown. The column is titled "Preliminary Open Coding Categories." Also included in Table 11 are descriptions of each category.

### 4.3.1. Open and Axial Coding

As the transcripts were studied, passages were coded appropriately as they fit into one or more of the categories. Subsequent to open and axial coding more detailed analyses were done on the data. The N6 tool provides a statistic that indicates the number of text lines identified from the transcripts that pertain to each category specified. This percentage allows for the investigator to double check the categorization by presenting the number of text lines in the transcripts that pertain to the particular category. The results are not final; however, they do assist in seeing if the amount of conversation on different subjects/categories coincides with the level of importance of categories that were given by the researcher. Table 12 includes the percentage of the total text lines from the eight manuscripts that pertain to each specific category in order of percentage of text lines.

In addition to the manual coding, which encompasses reading each transcript and identifying specific categories for phrases in the text, N6 facilitates search of text files for specific words or phrases. This search capability was used to identify text in the

**Table 11 – Preliminary Open and Axial Coding Categories**

| ***Preliminary Open Coding Categories*** | ***Description*** | ***Preliminary Axial Coding Categories*** |
|---|---|---|
| | | |
| - Technology Quality | Respondent comments on the Quality of the PDA | Quality |
| - Quality of Patient Care | Respondent comments on the quality of patient care | |
| | | |
| - Technology Substitution | Respondent comments on substitutes used to perform duties that can be performed by a PDA | Technology |
| - Technology Achievement | Respondent shows that they show a level of mastery in using the PDA | |
| - Technology Aptitude | Respondent shows that they have the knowledge to use a PDA (whether they do so or not) | |
| - Technology Use | Respondent's use of the PDA | |
| - Definition of Technology | Respondent's definition of technology | |
| | | |
| *None* | Form of communication that the respondent uses with patients | Communication |
| | | |
| - Subject Characteristics | Respondent's Characteristics | Characteristics |
| - Characteristics of the Organization | The respondent's perception of the organization's characteristics | |
| - Characteristics of the Technology | Characteristics of the technology (per the respondent) | |
| - Convenience | The respondents perception of the convenience of the PDA | |

| | | |
|---|---|---|
| - Changes wanted for the PDA | The changes that the respondent indicates they want | |
| - Limitations | The respondent's perception of the limitations | |
| - Makes you use a PDA | The respondent's perception of what it would take for them to use a PDA | |
| | | |
| - Perceived Ease of Use | The degree to which the respondent believes that using a PDA would be free from effort | Perceived Ease of Use |
| | | |
| - Perceived Usefulness | The degree to which the respondent believes that using a PDA would enhance his or her job performance | Perceived Usefulness |

manuscripts that contained the following words/phrases: "ease of use," "quality," "patient care," "easy," and "useful*." These particular phrases were used in order to extract information from the manuscripts that would best assist in answering the research questions. The asterisk (in useful*) is used as a wild card and catches such terms as useful as well as usefulness. After examination of the automated compilation of text lines, the phrases were manually identified and it was determined if the phrase was appropriately categorized. This manual operation consists of two steps: the first crossed reference the text line identified to the passage in the appropriate manuscript, and the second step entailed determining if the passage was appropriately categorized given the definition as stated in Table 11. The aforementioned automatic and manual coding activity produced statistics on the set of categories and sub-categories and not only shows the percentage of text lines that pertain to that topic (of all eight manuscripts) but

**Table 12 – Preliminary Coding Results**

| Preliminary Category | % of text lines | Number of Respondents (out of 8 total) |
|---|---|---|
| Technology/Substitution | 8.00% | 8 |
| Technology/Use | 5.50% | 8 |
| Perceived Ease of Use | 5.20% | 8 |
| Perceived Usefulness | 5.00% | 8 |
| Technology/Aptitude | 3.90% | 8 |
| Quality/Quality of Patient Care | 3.40% | 8 |
| Characteristics/Organization | 3.00% | 7 |
| Characteristics/Subject | 2.60% | 8 |
| Characteristics/Technology/Make you use a PDA | 2.60% | 7 |
| Characteristics/Technology/Changes wanted for PDA | 2.30% | 6 |
| Characteristics/Technology | 2.20% | 5 |
| Communication | 2.10% | 8 |
| Characteristics/Technology/Convenient | 1.90% | 8 |
| Technology/Definition | 1.80% | 8 |
| Technology/Achievement | 1.50% | 6 |
| *Search-Easy* | 1.40% | 8 |

| | | |
|---|---|---|
| Quality/Technology Quality | 0.79% | 3 |
| *Search-Patient Care* | 0.57% | 7 |
| *Search-Useful** | 0.56% | 6 |
| *Search-Quality* | 0.48% | 5 |
| *Search-Ease of Use* | 0.18% | 4 |

additionally indicates the number of respondents who discussed the category in their interview (shown in Table 12, column 3).

### 4.4. Examples of Coding

#### 4.4.1. Examples of Category Coding Technique

This section gives a detailed step-by-step process of the coding procedure to assist the reader in understanding how text within the manuscripts was categorized. As mentioned, the preliminary categories were determined a priori. Each manuscript was thoroughly read and examined in order to codify the sections of the manuscripts that fit in each of the categories. Figure 10 shows a key to the categories in order to cross reference how each manuscript was annotated to identify sections of the text that pertained to that particular code.

As can be seen by the text line under the line of pluses, this is the key to the document 1-EBlue-Interview 5-DS330003 (Interviewee E). "A" will denote the category

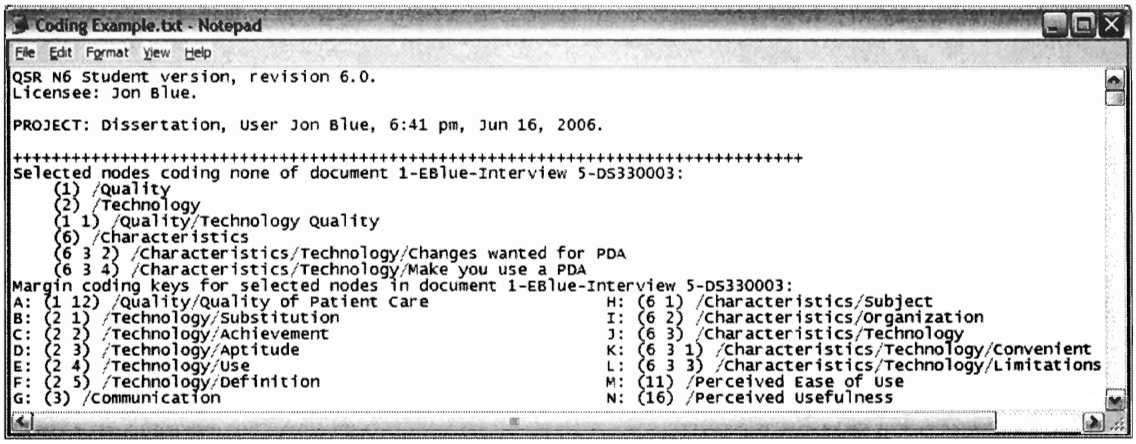
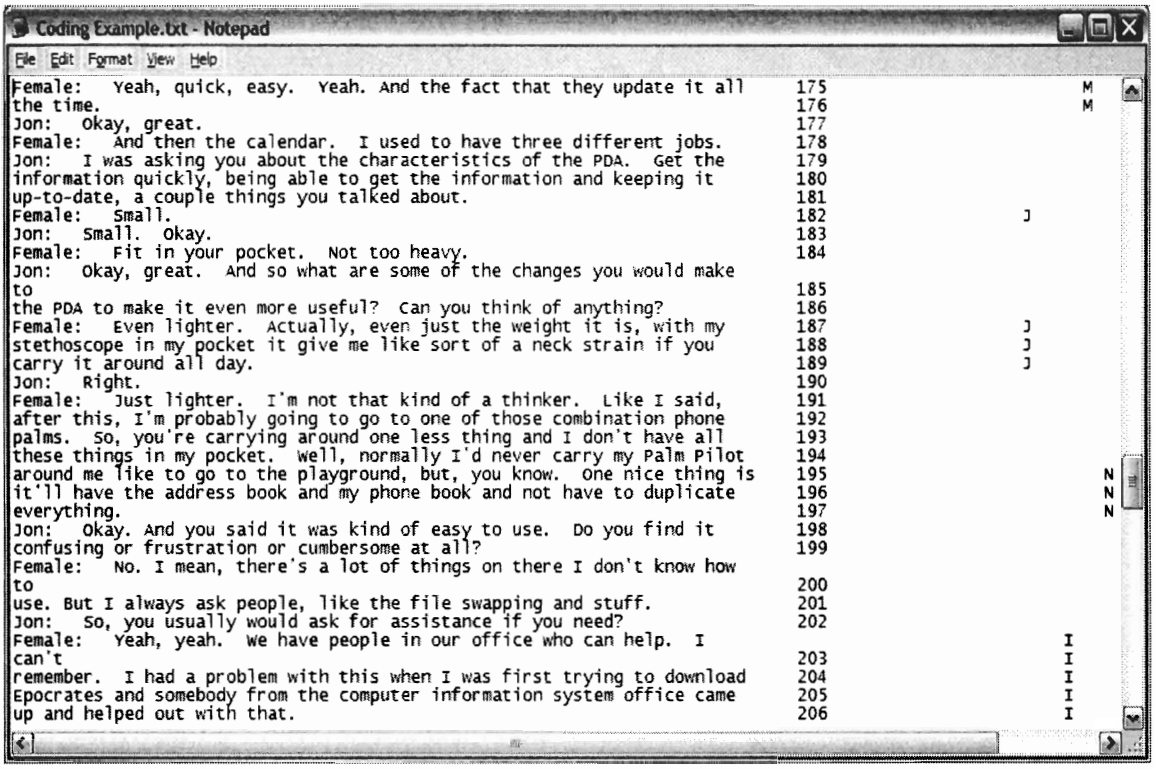



**Figure 10 – Key to Category Coding**

Quality of Patient Care, "B" will denote the category Technology Substitution, "C" will denote the category "Technology Achievement," and so on until "N," which represents "Perceived Usefulness." Figure 11 is an extraction from the interview manuscript for EBlue-Interview. First seen is a denotation of "M" next to lines 175 and 176 which reads: "**Female:** Yeah, quick, easy. Yeah. And the fact that they update it all the time." This indicates that these two lines are coded as "M: Perceived Ease of Use." Stepping down Figure 11 to line 182 (which says "**Female:** Small"), seen is "J." From our key in Figure 10 we see that "J" denotes the category "Characteristics/Technology." Also coded as "Characteristics/Technology," are lines 187, 188, and 189. These lines are: "**Female:** Even lighter. Actually, even just the weight it is, with my stethoscope in my pocket it give me like sort of a neck strain if you carry it around all day." Lines 195, 196, and 197 are coded with "N." The key in Figure 10 indicates that "N" is "Perceived Usefulness." This was coded as such because the interviewee said: "One nice thing is it'll have the address book and my phone book and not have to duplicate everything." Lastly, our


Coding Example.txt - Notepad

File Edit Format View Help

| | | | | |
|---|---|---|---|---|
| Female: Yeah, quick, easy. Yeah. And the fact that they update it all | 175 | | | M |
| the time. | 176 | | | M |
| Jon: Okay, great. | 177 | | | |
| Female: And then the calendar. I used to have three different jobs. | 178 | | | |
| Jon: I was asking you about the characteristics of the PDA. Get the | 179 | | | |
| information quickly, being able to get the information and keeping it | 180 | | | |
| up-to-date, a couple things you talked about. | 181 | | | |
| Female: Small. | 182 | | J | |
| Jon: Small. Okay. | 183 | | | |
| Female: Fit in your pocket. Not too heavy. | 184 | | | |
| Jon: Okay, great. And so what are some of the changes you would make | | | | |
| to | 185 | | | |
| the PDA to make it even more useful? Can you think of anything? | 186 | | | |
| Female: Even lighter. Actually, even just the weight it is, with my | 187 | | J | |
| stethoscope in my pocket it give me like sort of a neck strain if you | 188 | | J | |
| carry it around all day. | 189 | | J | |
| Jon: Right. | 190 | | | |
| Female: Just lighter. I'm not that kind of a thinker. Like I said, | 191 | | | |
| after this, I'm probably going to go to one of those combination phone | 192 | | | |
| palms. So, you're carrying around one less thing and I don't have all | 193 | | | |
| these things in my pocket. Well, normally I'd never carry my Palm Pilot | 194 | | | |
| around me like to go to the playground, but, you know. One nice thing is | 195 | | | N |
| it'll have the address book and my phone book and not have to duplicate | 196 | | | N |
| everything. | 197 | | | N |
| Jon: Okay. And you said it was kind of easy to use. Do you find it | 198 | | | |
| confusing or frustration or cumbersome at all? | 199 | | | |
| Female: No. I mean, there's a lot of things on there I don't know how | | | | |
| to | 200 | | | |
| use. But I always ask people, like the file swapping and stuff. | 201 | | | |
| Jon: So, you usually would ask for assistance if you need? | 202 | | | |
| Female: Yeah, yeah. We have people in our office who can help. I | | | I | |
| can't | 203 | | I | |
| remember. I had a problem with this when I was first trying to download | 204 | | I | |
| Epocrates and somebody from the computer information system office came | 205 | | I | |
| up and helped out with that. | 206 | | I | |

**Figure 11 – Example of Coded Manuscript**

example is keyed with an "I." "I" denotes "Characteristics/Organization" and is coded this way on line 202 through line 206. The interviewee said: "Yeah, yeah. We have people in our office who can help. I can't remember. I had a problem with this when I was first trying to download Epocrates and somebody from the computer information system office came up and helped out with that." This example shows how each of the eight manuscripts was coded with the appropriate categories based on the text. The N6 program then calculates statistics on each category which denotes the percentage of lines in the manuscripts that are coded for each category. For instance, looking at Table 12 on page 112, the statistic from the software indicates that "Technology/Substitution" was coded on eight percent of the total text lines in all eight manuscripts. And the category

**Table 13 – Suggested Propositions Produced from Interview Data**

| # | Phenomenon | % of text lines | # of Respondents (out of 8 total) |
|---|---|---|---|
| 1 | Physicians are aware of PDA use and capabilities. | 4.00% | 8 |
| 2 | Physicians use PDA substitutes to assist them in delivering care to patients. | 3.20% | 7 |
| 3 | Physicians who use (or have used) a PDA in their practice primarily use the PDA for drug information. | 2.90% | 5 |
| 4 | Physicians at VCU are dissuaded from using some forms of technology because of organization security concerns and policy. | 2.30% | 6 |
| 5 | Physicians who use (or have used) a PDA find the PDA easy to use. | 2.00% | 6 |
| 6 | If the PDA improved patient care then they would use it – regardless of how difficult it was to use. | 2.00% | 8 |
| 7 | Physicians who use (or have used) a PDA synchronize (hot sync) their PDA regularly to keep it up to date. | 1.40% | 5 |

"Technology/Substitution" has been identified as being resident at least once in each of the eight manuscripts.

## 4.5. Case Study Propositions

The open and axial coding techniques used previously greatly assisted in this next coding technique, which is referred to as completion coding[3] which resulted in the identification of improved propositions. It is called completion coding because the activity ensures that all of the propositions have been completely extracted from the manuscripts. The open and axial coding was helpful because having a prior knowledge of the importance of specific categories increased my level of sensitivity in recognizing possible phenomena. This process entailed proceeding through each of the manuscripts line by line. Traversing the manuscripts meticulously was done to extract as much information from the transcripts as possible in order to suggest plausible propositions. Each phenomenon was recorded as it was discovered. The process was cyclical in that if a phenomenon was identified then in order for it to remain a proposition, it could not be refuted by another interviewee. Therefore, as stated, the process was tedious, but quite useful in discovering propositions. The main propositions that resulted are shown in Table 13 on page 116. Appendix F on page 193 is a table of all of the phenomena that were extracted from the process. The arbitrary cut off of the propositions was that a majority of the eight physicians had to indicate the phenomenon. Therefore, of relevance, and what are presented as propositions, are shown in Table 13. This iterative approach where the propositions were compared to ensure corroboration and no refutations were

[3] The term "completion coding" was coined by A. S. Lee in a personal communication on July 13, 2006.

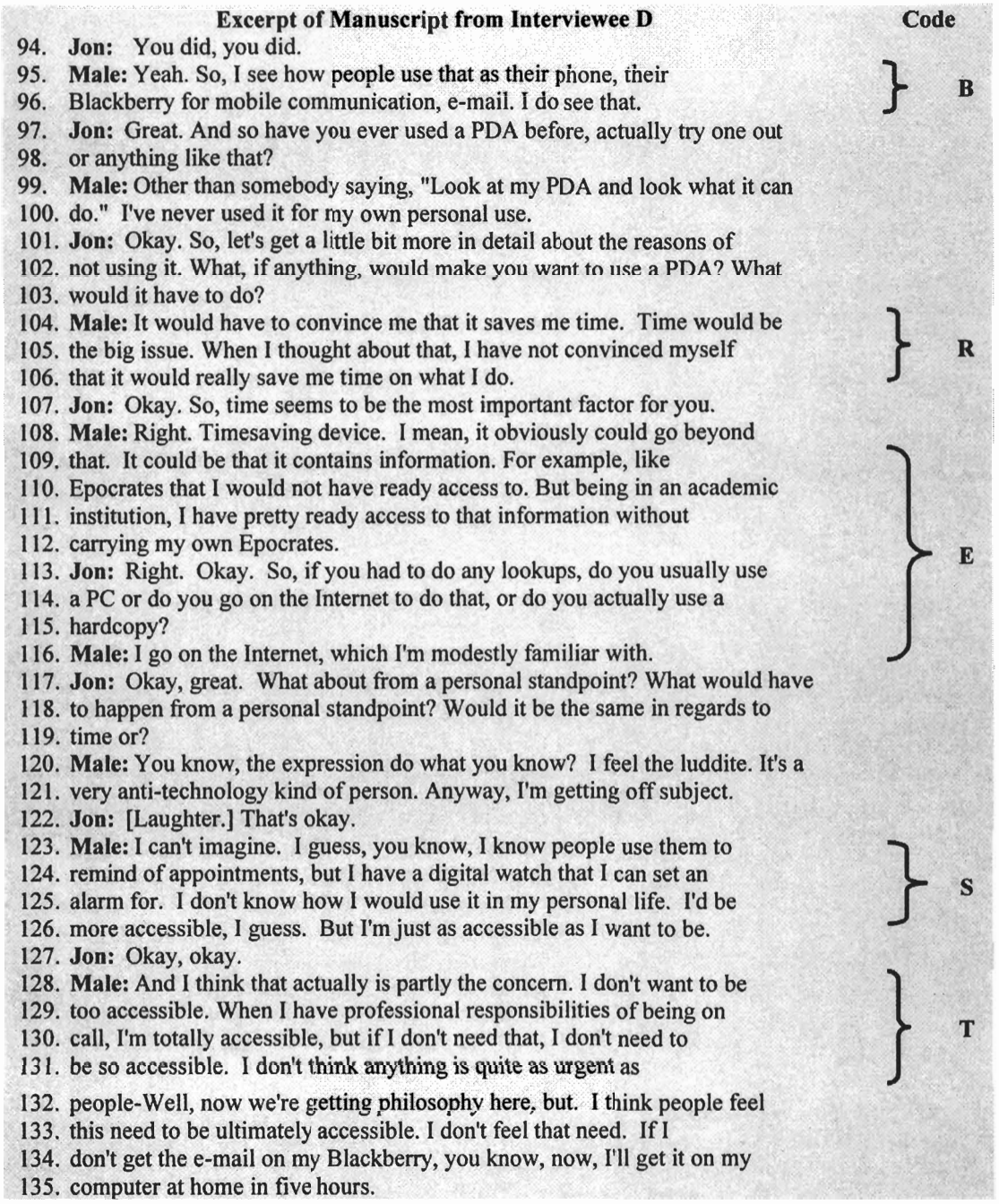



**Figure 12 – Example of Codification of Manuscript for Propositions**

present in other manuscripts, is a form of hypothetico-deductive logic as explained on page 79 (Allen S. Lee, personal communication, Jun 8, 2006).

### 4.5.1. Example of Study Proposition Extraction

In this section an example is given on how the cyclical process of proposition extraction was conducted using hypothetico-deductive logic. In order to relay the process of determining phenomena in the manuscripts, a small part of the process that was followed is detailed below.

Figure 12 is a small section of a manuscript. This example begins on line 94 of the completion investigation of the manuscript from Interview 4 with Interviewee D. As can be seen in Table 10 on page 107, Interviewee D is a male who does not currently use a PDA, and has never used one. Already completed has been the line by line examination of manuscripts A, B, and C. Currently, Interview D is being coded. Manuscripts A, B, and C have produced the plausible propositions that are shown in Figure 13. Item K which reads "~~Physicians consider the PDA as a temperamental device~~" in the figure has been crossed out because this possible proposition existed in a manuscript; however, it was discovered to be an incorrect proposition based on another manuscript (it is assumed to be a proposition unless it is discovered not to be true based on data obtained from another manuscript).

Shown in Figure 12 is how the example manuscript is coded. As the manuscript is traversed down to lines 95-96, these lines are given a code of "B." Lines 95 to 96 indicate that the interviewee said "Yeah, So, I see how people use that as their phone, their Blackberry for mobile communication, email. I do see that." As we cross reference our code of "B" back to Figure 13 we see that "B" says "Physicians are aware of PDA use in

A. Physicians at VCU Health Systems are dissuaded from using some forms of technology because of organizational security concerns and policies.
B. Physicians are aware of PDA use in general and/or in health care.
C. Doctors use other technology to assist them in delivering care to patients.
D. Physicians who have a PDA use (or had a PDA used) it first, if possible, even if they have access to other sources to assist in delivering care.
E. Physicians have access to substitute technologies and other items to assist them in delivering patient care.
F. Physicians who use (or have used) a PDA find the PDA easy to use.
G. Physicians who use (or have used) a PDA in their practice primarily use the PDA for drug information.
H. Physicians who use (or have used) a PDA hot synchronize[4] their PDA regularly to keep it up to date.
I. PDA use is quick.
J. PDA's are handy/accessible/convenient.
~~K. Physicians consider the PDA as a temperamental device~~
L. Physicians who use (or have used) a PDA find it easier to use when they do not have a computer in the patient room.
M. Physicians that use a PDA want to keep it.
N. If the physician perceives that the PDA improved patient care then they would use one.
O. Physicians that use (or have used) their PDA, most often keep it up-to-date (i.e., hot synchronizing it, entering information). – *(like H)*
P. If support for the PDA were more readily available then usage would increase.
Q. Physicians like having separate technology tools, e.g., PDA, phone, pager, in different devices.

**Figure 13 – Physician Technology Use Possible Propositions**

general and/or in health care." We continue our perusal down Figure 12 and see that on line 104 to 106, Interviewee D says, "It would have to convince me that it saves me time. Time would be the big issue. When I thought about that, I have not convinced myself that it would really save me time on what I do." In reading this statement, and knowing that Interviewee D is a non-PDA user, a plausible proposition is: "Physicians that don't use a PDA have to be convinced that using one would save them time."

[4] "Hot sync" is a term that means synchronizing the hand held unit, either wired or wirelessly, with the internet, or data source to have the most current information in the device.

The next step is to determine if the proposition "Physicians that don't use a PDA have to be convinced that using one would save them time" is already suggested, or if it negates another proposition. As we go back to Figure 13, we look down our proposition list and determine if a proposition that describes this prior statement is present or negates a current proposition. If a proposition was negated, then it would be crossed out. Since it was not present, and not negated, it is added to our proposition list and given a code of "R" as shown in Figure 14

Continuing to read through the manuscript in Figure 12, on lines 109 through line 116, the interview takes the following form:

This exchange can be described as "Substitutes are available for the Physician." Looking again through the possible propositions from Figure 13 (and now also Figure 14), it can be seen that item "E" duplicates this phenomenon in that it states "Physicians have access to substitute technology and other items to assist them in delivering patient care."

**Male: ...** For example, like Epocrates that I would not have ready access to. But being in an academic institution, I have pretty ready access to that information without carrying my own Epocrates.

**Jon:** Right. Okay. So, if you had to do any lookups, do you usually use a PC or do you go on the Internet to do that, or do you actually use a hardcopy?

**Male:** I go on the Internet, which I'm modestly familiar with.

Therefore, this segment of the manuscript (line 109 through line 116) would be coded as "E."

| | |
|---|---|
| R. | "Physicians that don't use a PDA have to be convinced that using one would save them time." |
| S. | Physicians that do not use a PDA do not feel they would ever have a use for one in their personal lives. |
| T. | Physicians that do not use a PDA do not want to be accessible. |

**Figure 14 – Added Possible Propositions (from example in Figure 12)**

Continuing down the manuscript, lines 123 through 126 introduces another possible proposition (it does not exist in our possible propositions in Figure 13 or Figure 14, nor does it negate an existing possible proposition) as "Physicians that do not use a PDA do not feel they would ever have a use for one in their personal lives." This possible proposition is added to our list as "S" and is shown in Figure 14. Similarly, looking at lines 128 through 131, "T" is added as a possible proposition. "T" is "Physicians that do not use a PDA do not want to be accessible." This too is shown in Figure 14.

This iterative process continues throughout the codification process and the results are all the possible propositions that are presented in Appendix F on page 193. The reduced list is presented in Table 13 on page 116. Listed are those phenomena where a majority of the physicians that were interviewed in this study confirm the phenomenon.

From this process, Phenomenon 1 and 7 from Table 13 are statements about characteristics of the physicians. It is suggested in Phenomenon 1 that physicians are well informed of what PDA can and cannot do. Therefore, the decision to use or not to use a PDA in their practice is influenced by accurate information about the capabilities of the technology. In addition, Phenomenon 7 gives information about users of PDAs. This phenomenon says that those that use (or have used) a PDA prefer it to be current. The device is kept current by synchronizing (updating) the device regularly with information on the internet. The information on the internet is normally the most current.

Phenomenon 2 indicates that seven of the eight physicians that were studied use substitutes in their practice, which can threaten the use of specific technologies. Phenomenon 3 says that physicians mainly used the PDA to obtain drug information. This information is primarily drug explanations, interactions, and calculations to determine correct dosages. Phenomenon 4 is key in that it states that physicians' organizational policies effect technology use and non-use. And lastly, phenomena 5 and 6 address ease of use and usefulness (the study questions). Physicians who use the PDA find it easy to use and also even if it were not easy to use, if patient care is positively affected, they would use the technology. Given that these phenomena have been ascertained, a rebuilt theory that pertains to physicians is presented in Chapter 5.

# CHAPTER 5
# SYNTHESIS OF FINDINGS

The resultant plausible propositions that were presented in Chapter 4, as well as the categories extracted from the interview data, facilitate a natural transition to presenting the Physicians' Technology Acceptance Model (PTAM). PTAM is a model that is more accurate than TAM, or the Extended TAM, in predicting a physician's behavioral intention to use a technology.

## 5.1. Physicians' Technology Acceptance Model

The coding and analysis of the data resulted in very useful information which assisted in the development of PTAM. As is corroborated in Table 13 on page 116, physicians are aware of the use and capabilities of the PDA in delivering health care. But the data also show that the organization's policies moderate the use of technology. For instance, several of the interviewees indicated that they do not use email to communicate with patients because of the lack of security in email. Table 13 also presents analyzed data that the most common uses of a PDA in the VCU Health System and Student Health organizations are to look up drugs, drug interactions, dosage, and side effects. Even those physicians that do not currently use a PDA admit that the device would be advantageous in providing pharmaceutical information.

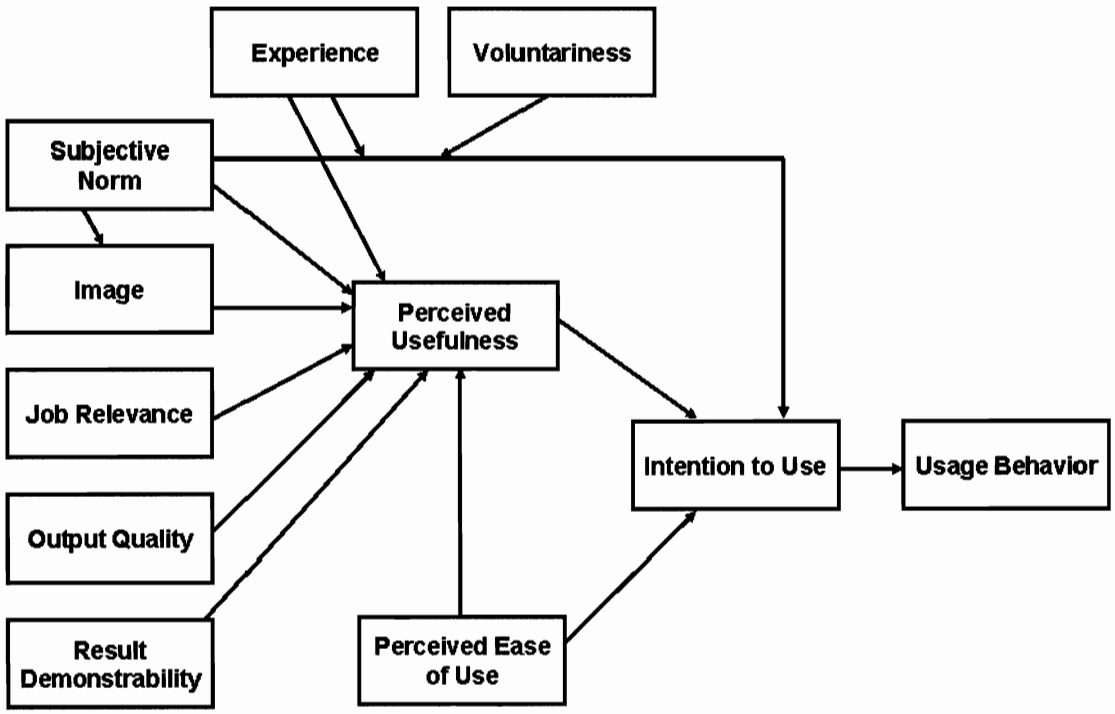



**Figure 15 – Extended TAM**

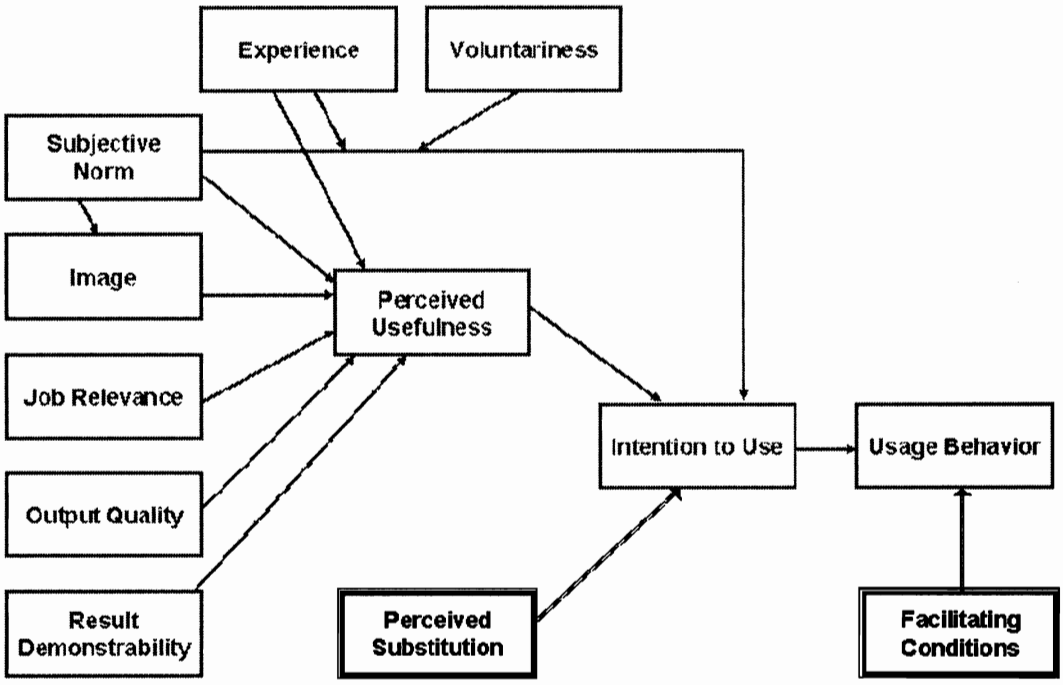



**Figure 16 – Physicians' Technology Acceptance Model (PTAM)**

What is apparent after analyzing the data is that the physicians seem to have and use alternative tools (or substitutions) to deliver care. Specifically, VCU Health System and Student Health organizations provide the program known as Up-to-Date. Up-to-Date is a software program accessible to any physician that is employed in the organization. Up-to-Date provides an abundance of information usable by the physician in delivering care to patients. The server software program provides much of the same information provided by a PDA, including information on different ailments and diseases. Also, Up-to-Date gives the physicians differentials that can be considered in determining patients' illnesses. Having such a substitute like Up-to-Date readily available (often inside of the patient room) which often exceeds the capabilities of the assistance provided by a PDA, dissuades the use of the PDA as a device to use to assist in delivering care.

To assist in comparing the Extended TAM and PTAM, both models are presented in Figure 15 and Figure 16 on page 125. The grayed out constructs that are in Figure 16 are part of both the Extended TAM and PTAM but were not specifically investigated in this research. The changes made to the Extended TAM which resulted in PTAM are suggested as a result of the information provided by the open, axial, and completion coding. As can be seen on page 125 the variable perceived ease of use, as shown in Figure 15, is not a variable in PTAM and is absent in our new model (Figure 16). The variables that are absent from the Extended TAM, and present in PTAM, are depicted with the double line borders. These new variables are perceived substitution and facilitating conditions.

Like the Extended TAM, PTAM has the theoretical constructs spanning cognitive instrumental processes (job relevance, output quality, and result demonstrability) and social

influence processes (subjective norm, voluntariness, and image). As discussed, absent is the variable perceived ease of use. One of the added constructs, perceived substitution, is introduced as a cognitive instrumental process. The other added variable, facilitating conditions, introduced by Venkatesh et al. (2003, p. 453), is defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

The theoretical constructs of PTAM are:

- Cognitive Instrumental Processes

  There are four cognitive instrumental determinants of perceived usefulness: perceived substitution (introduced in this research), job relevance, output quality, and result demonstrability.

  - *Perceived Substitution:* The degree to which an individual perceives that alternate sources are available to deliver the same information or assistance as the technology in question.
  - *Job relevance:* An individual's perception regarding the degree to which the technology is applicable to his or her job.
  - *Output Quality:* Defined as how well the system performs the tasks of their job. (This is above and beyond the degree to which tasks match their job goals (job relevance)).
  - *Result Demonstrability:* the "tangibility of the results of using the innovation" (Moore and Benbasat, 1991, p. 203).

- Social Influence Processes

  In PTAM there are the interrelated social forces on an individual that are before an individual who can choose to accept or reject a new technology. These three social influence processes are subjective norm, voluntariness, and image.

  - *Subjective norm: A* "person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975, p. 302).

    *Voluntariness: A* moderating variable defined as "the extent to which potential adopters perceive the adoption decision to be non-mandatory" (Agarwal and Prasad 1997, Hartwick and Barki 1994, Moore and Benbasat 1991).

    *Image:* "the degree to which use of an innovation is perceived to enhance one's...status in one's social system" (Moore and Benbasat, 1991, p. 195).

- *Perceived Usefulness*: The extent to which a person believes that using the technology will enhance his or her job performance,
- *Experience:* The amount of time a user has with the proposed technology,
- *Intention to Use*: The behavioral intention to use the proposed technology, and
- *Facilitating Conditions:* The degree to which an individual believes that an organizational and technical infrastructure exist to support use of the system.

## 5.2. Differences between PTAM and TAM (why PTAM is better)

TAM and the Extended TAM have the variable "perceived ease of use" as a moderator of "perceived usefulness" and as a determinate of the "behavioral intention to use"

a technology. PTAM does not include perceived ease of use. As has been shown, the data indicates that physicians are 1) not concerned with how easy a technology is to use in order to use it if there is some value in the technology, and 2) if there is usefulness in the technology (this being that it improves the quality of patient care) then it does not matter if the technology is easy to use. One respondent went so far to say, "If it improved my patient's care, I wouldn't really care if it were difficult. I use a lot of things that aren't easy to use. Take this blood pressure cuff. It can be a pain but the electronic ones aren't accurate so most of us still use the cuff and stethoscope." This shows that physicians often use tools that are difficult, but if it results in high quality care, then they would use the tool.

### 5.2.1. Perceived Substitution

An additional variable introduced in this research is PTAM's theoretical construct called "Perceived Substitution." As stated, perceived substitution is defined as "the degree to which an individual perceives that alternate sources are available to deliver the same information or assistance as the technology in question." With the increase in the availability of technologies in heath care environments, many of these tools are used to assist physicians in delivering care (Gadd et al. 1999; Gadd et al. 2001; Lærum et al. 2001; Michalowski et al. 2004; Murff et al. 2001). Analysis of the data from this study shows that these substitutes are often perceived by the physicians to be equally, if not more useful in delivery care to patients. Therefore, physicians will not necessarily use a technology if there are suitable substitutes available. The variable "perceived substitution" is predicted to be negatively correlated to the behavioral intention to use a technology. So as the physicians increase their

perception that substitutes are available that will assist them in delivering care, the less the behavioral intention to use will be.

### 5.2.2. Facilitating Conditions

As presented by Venkatesh et al. (2003), facilitating conditions embodies concepts from three different constructs: perceived behavioral control from the Theory of Planned Behavior, facilitating conditions from the combined model of TAM and the Theory of Planned Behavior, and compatibility from the Innovation Diffusion Theory. Perceived behavioral control as introduced by Ajzen (1991) and Taylor and Todd (1995a; 1995b) are perceptions of external and internal constraints on behavior and consists of resource and technology facilitating conditions as well as self-efficacy. Facilitating conditions introduced by (Thompson et al. 1991) are objective environmental factors that observers agree make a task easier to perform. Compatibility as defined by Moore and Benbasat (1991) is the degree to which an innovation is perceived as being consistent with the adopter's existing needs, experiences, and values.

## 5.3. The Greater Explanatory Power of PTAM

PTAM more accurately predicts a physician's behavioral intention to use a technology. As was discussed in Section 2.3 on page 63, there have been several failed attempts at assessing technology acceptance in different environments. Here we revisit several of these studies and show how PTAM more accurately predicts physicians behavioral intention to use technology. While this study used the PDA as the technology instantiation,

the other studies applied acceptance models using different technologies. Even with studying

**Table 14 – PTAM's Comparison**

| Title | Authors(s) (Year) | Inconsistencies with TAM / Extended TAM | PTAM Applied |
|---|---|---|---|
| An Empirical Assessment of a Modified Technology Acceptance Model | Chau (1996) | • No significant, direct relationship was found between ease of use and behavioral intention to use a technology. | PTAM supports this finding with the absence of Perceived Ease of Use |
| Examining a Model of Information Technology Acceptance by Individual Professionals: An Exploratory Study | Chau and Hu (2002a) | • Professionals differ in their technology acceptance decision-making (compared with end users and business managers). | *Not Applicable* |
| | | • Decision making anchored in the usefulness of the technology (versus ease of use). | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Physicians concerned about the compatibility of the technology with their practices. | *Not Applicable* |
| | | • Physicians place little importance on controlling technology operations. | *Not Applicable* |
| | | • Physicians place limited weight on peers' opinions. | *Not Applicable* |
| A Test of the Extended Technology Acceptance Model for Understanding the Internet adoption Behavior of Physicians | Wiley-Patton (2002) | • Perceived ease of use did not predict the behavioral intention to use. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Perceived ease of use did not have a significant effect on perceived usefulness. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Image, subjective norm, and result demonstrability were not significant. | *Not Applicable* |

| | | | |
|---|---|---|---|
| Test of the Technology Acceptance Model for the Internet in Pediatrics | Chismar and Wiley-Patton (2002) | • Perceived ease of use did not predict the behavioral intention to use. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Perceived ease of use did not have a significant effect on perceived usefulness. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Image and subjective norm were not significant. | *Not Applicable* |
| Does the Extended Technology Acceptance Model Apply to Physicians | Chismar and Wiley-Patton (2003) | • Perceived ease of use did not predict the behavioral intention to use. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Perceived ease of use did not have a significant effect on perceived usefulness. | PTAM supports this finding with the absence of Perceived Ease of Use |
| | | • Image, subjective norm, and result demonstrability were not significant. | *Not Applicable* |
| Understanding Information Technology Acceptance by Individual Professionals: Toward an Integrative View | Yi, Jackson, Park, and Probst (2006) | • Perceived ease of use was not a significant determinant of behavioral intention. | PTAM supports this finding with the absence of Perceived Ease of Use |

the acceptance of different technologies, PTAM is applicable and is corroborated. Also, this research specifically looked at perceived ease of use and this variable's applicability in health care technology acceptance. The prevalent theme across many of these studies that do not confirm TAM is the non-significance of the relationship between perceived ease of use and perceived usefulness or the relationship between perceived ease of use and the behavioral intention to use. Because the new model presented does not include the ease of use variable, this non-confirmation does not exist with PTAM.

The six articles that are used to show PTAM's predictive ability are "An Empirical Assessment of a Modified Technology Acceptance Model" (Chau 1996), "Examining a Model of Information technology Acceptance by Individual Professionals: An Exploratory Study" (Chau et al. 2002a), "A Test of the Extended Technology Acceptance Model for Understanding the Internet adoption Behavior of Physicians" (Wiley-Patton 2002), "Test of the Technology Acceptance Model for the Internet in Pediatrics" (Chismar et al. 2002), "Does the Extended Technology Acceptance Model Apply to Physicians" (Chismar et al. 2003), and "Understanding Information Technology Acceptance by Individual Professionals: Toward an Integrative View" (Yi et al. 2006).

Several of the studies that are presented in Table 14 show other critiques that do not include perceived ease of use and *"Not Applicable"* is indicated in column 4 which means that a comparison of this finding via an improved technology acceptance model is not applicable to this study (given that the focus of this study is primarily on perceived ease of use).

## 5.4. Nine Criteria to Assess Validity

As stated in Section 3.2.8, certain criteria must exist for the theory to be valid. In this section, PTAM is examined to ensure that it meets these criteria. The results are summarized in Table 15.

### 5.4.1. Four Validity Requirements of a Theory by Yin (1994)

The four criteria of validity as presented by Yin (1994) are:

1) Construct validity,

2) Internal validity,

3) External validity, and

4) Reliability.

We now examine PTAM to ensure that it meets the specific requirements.

Construct Validity

As suggested by Yin (1994), to increase construct validity one should use multiple sources of evidence (converging on the same set of facts or findings), and/or establish a chain of evidence (link between the questions asked, the data collected, and the conclusion drawn, and/or have the draft case study report reviewed by key informants and participants) (pp. 34 – 35).

To establish construct validity this research establishes a chain of evidence. Available is a summary of the study (this document) as well as a document repository which contains the manuscripts, notes, the instrument questions, and the procedures (general rules) of conducting the interview. The protocol is part of the research synopsis (can be reviewed in Appendix E on page 177).

Additionally, to increase construct validity, the data analysis results, the synthesis of findings, and the conclusion; Chapters 4, 5, and 6; of this dissertation were presented to a participant physician to ensure that there is agreement with the facts of the case as presented. The physician agreed with the facts.

Internal Validity

Yin suggests that "explanation building" can be used to assist researchers in increasing a study's internal validity. This study uses a positivist case study research

**Table 15 – Validity Criteria**

| Criterion | Activity |
|---|---|
| Construct Validity (Yin 1994) | - Chain of evidence established by having a copy of preliminary questions asked of respondents (See Appendix E), the transcript of each interview. This dissertation serves as the case study report.<br>- The Data Analysis Results, Synthesis of Findings, and Conclusion chapters of this dissertation were reviewed by a physician that participated in the study. |
| Internal Validity (Yin 1994) | - N6 used to assist in analysis<br>- Explanation Building used (Yin 1994)<br>- Used hypothetico-deductive logic |
| External Validity (Yin 1994) | - Analytical generalization obtained<br>- Other domains presented for future research: Other academic health systems, hospital, and private practice organizations |
| Reliability (Yin 1994) | - This dissertation is available to a researcher<br>- The document repository is available |
| Falsifiability (Lee 1989a; Lee 1989b) | - Study can be conducted in another health care organization and PTAM can be shown to be incorrect |
| Logically consistency (Lee 1989a; Lee 1989b) | - No inconsistencies are apparent in PTAM constructs |
| Relative predictive power (Lee 1989a; Lee 1989b) | - Shown to predict physicians' behavioral intention to use better that TAM and the Extended TAM |
| Survivability (Lee 1989a; Lee 1989b) | - *Future Research* |
| Comparative validity (Allen S. Lee, personal communication, April 28, 2006) | - As shown in Table 14, Page 131, PTAM more accurately predicts physicians' acceptance of technology |

approach, as specified by Yin (1994), and uses the "natural science model" of empirical inquiry using the rules of hypothetico-deductive logic, as presented by Lee (1989a; 1989b) to satisfy this criterion.

Yin (1994) says about explanation building, "analyze the case study data by building an explanation about the case" (p. 110). Stipulating causal links equates to "explaining a phenomenon" (p. 110). Yin purports that better case studies are those where the explanation reflects some theoretically significant propositions. The theoretical propositions that have been produced from the completion coding technique explain the behavioral intention to use PDAs by physicians. This process was iterative as Yin (1994) suggested and as case study evidence was reviewed, the theoretical propositions were revised or deleted, and the evidence was again examined. This procedure was done using hypothetico-deductive logic and this research satisfies the criterion of internal validity.

External Validity

Because this is a case study, and not survey research, this study's aim is to have analytical generalization. In analytical generalization, the researcher's goal is to generalize a specific set of results to some broader theory (Yin 1994, p.36). This broader theory is presented as PTAM. Additionally, Yin states that external validity is obtained by "establishing the domain to which a study's findings can be generalized" (p. 34). The site that this research focuses on is the VCU Heath System and VCU Student Health. This study's findings can be generalized to other organizational environments that employ physicians who treat patients. This can be other academic environments, hospital organizations, or private practice organizations. Also as shown, PTAM when applied to

another physician environment, more accurately predicts physicians' behavioral intention to use technology. This satisfies the external validity criterion.

Reliability

Yin states that this study is reliable if another researcher were able to similarly conduct the research and obtain the same results. This study is reliable because available for a researcher who wishes to duplicate this study are this dissertation, and the document repository which contains all of the documentation of this study.

### 5.4.2. Four Validity Requirements of a Theory by Lee (1989a)

The four criteria of validity as presented by Lee (1989a) are:

1) Falsifiability,
2) Logical consistency,
3) Relative predictive power, and
4) Survivability.

Falsifiability

Lee (1989a; 1989b; 1991) suggests that this study is falsifiable if there is a possibility that PTAM can be falsified. This criterion is satisfied because a study can be conducted in a health care environment where physicians are using PDAs and the results indicate that PTAM does not predict physicians' behavioral intention to use technology.

Logical Consistency

PTAM has logical consistency. The model does not contain any constructs that are contrary to one another or refute one another. The base theory is the Extended TAM and the

addition of the two additional constructs, perceived substitutability and facilitating conditions do not contradict one another or any other constructs in the presented model. Therefore, PTAM has logical consistency.

Relative Predictive Power

To satisfy this criterion it is necessary for PTAM to equally or better explain a physician's behavioral intention to use a technology. The major rival theories are TAM and the Extended TAM. These theories have repeatedly failed to accurately predict physicians' behavioral intention to use technology. These two aforementioned models include the variable perceived ease of use and analysis of the data from this case study indicates that this variable is not warranted. Additionally, as is shown in Table 14 on page 131, as well as described in Section 5.3 on page 130, PTAM out-predicts current technology acceptance models.

Survivability

Survivability exists if PTAM can stand up against attempts of falsification. Since this study is a single case study, attempts to satisfy this requirement will be left to future research. The resultant theory can be applied in other health care organizations to determine if PTAM is applicable.

### 5.4.3. Comparative Validity as Conceptualized by Lee (personal communication, April 28, 2006)

Comparative validity exists if it is possible to show that the new theory successfully explains previous refutations. As has been shown in Section 5.3 on page 130, when PTAM is

applied to situations where other technology acceptance models failed to accurately predict behavioral intention to use technology by physicians, PTAM out performs these models. The research that PTAM out performs is shown in Table 14 on page 131 and applies to: Chau (1996), Chau and Hu (2002a), Wiley-Patton (2002), Chismar and Wiley-Patton (2002), Chismar and Wiley-Patton (2003), and Yi, Jackson, Park, and Probst (2006).

# CHAPTER 6
# CONCLUSION

This dissertation is a positivist case study that presents a rebuilt technology acceptance model known as PTAM, The Physicians' Technology Acceptance Model. Using the Extended TAM as the base, this new model more accurately predicts physicians' behavioral intention to use a technology.

The goal of this case study was to present plausible changes to technology acceptance theories to better explain the determinants of physicians' behavioral intention to use technology. Based on data obtained from eight physicians, using a qualitative study, this research presents a rebuilt technology acceptance model that is absent of the variable perceived ease of use (which is present in TAM and the Extended TAM) and adds two constructs, perceived substitution and facilitating conditions (Venkatesh et al. 2003) (which are absent from TAM and the Extended TAM).

The Extended TAM has the variable perceived ease of use as an indirect predictor of the behavioral intention to use (as a moderator to perceived usefulness), and as a direct predictor of the behavioral intention to use. As a rebuilt technology acceptance model, PTAM does not have perceived ease of use as a construct. The data shows that since the ultimate goal of a physician is to deliver quality patient care, a tool's difficulty of use is irrelevant.

Perceived substitution is defined as "the degree to which an individual perceives that alternate sources are available to deliver the same information or assistance as the technology in question." This substitution can be either a technical tool such as a personal computer or a non-technical tool such as a textbook like the Physician's Desk Reference (PDR). As can be seen in the figures of TAM, **Error! Reference source not found.**, page **Error! Bookmark not defined.**, and the Extended TAM, Figure 2, page 12, this construct is not present.

An additional construct that is introduced in PTAM is titled facilitating conditions. This construct is identical to the construct introduced by Venkatesh et al. (2003). These authors recognized that there are circumstances that are not internal to the individual that persuade or dissuade the behavioral intention to use a technology. The findings from this study support these findings and facilitating conditions such as policy, availability of resources, and training are considered by physicians when determining whether to use or not use a technology.

### 6.1. Research Questions Revisited

Two research questions guided this study. The first question is: What is it about physicians and their environments that cause TAM's prediction that *perceived ease of use* influences *perceived usefulness* to be incorrect? As was discussed above, this study shows that the physicians who took part in this research are not concerned with the difficulty of using a technology if it is shown that it will improve patient care. The data

**Table 16 – Perceived Ease of Use / Quality Care**

| |
|---|
| Response: "If it improved my patient's care I wouldn't really care if it were difficult. I use a lot of things that aren't easy to use. Take this blood pressure cuff. It can be a pain but the electronic ones aren't accurate so most of us still use the cuff and stethoscope." |
| Response: "I'm pretty sure I would [use a PDA] if I found that it [PDA] help me with patients more. It doesn't matter if it were difficult. I would learn how to use it. I'm sure I would." |
| Response: "I'm sure I would use it if it increased the quality of care of my patients. But I don't find it that difficult." |
| Interviewer: If you had that piece of technology where it was a little bit more difficult to use, however, it actually was a little bit more efficient than using other ways-in other words, the data was better. I'm not saying it is. But the data is better or it actually improves patient care based on using that technology<br>Response: "Yes, then I would use it." |
| Interviewer: …Would you use it if you found out that using a PDA had the right type of data and information even if it were more difficult to use it?<br>Response: "Yeah. I mean, if it overall improved efficiency I would, yeah." |
| Interviewer: "…if something was very useful for your practice in dealing with your patients and doing your charting, if it's useful, you would actually take the step to say, I don't really care if it's easy or hard.<br>Response: "Right."<br>Interviewer: "…if it's going to help, I'll go ahead and do it.<br>Response: "Yeah, yeah. I mean, I'm assuming you probably like the initial step of actually learning it. Yeah, yeah. I think it takes time. And if it's going to improve, like I said, improve efficiency and improve the quality of patient care, of course. |
| Interviewer: "If you found that the use of a PDA really increase your delivery of quality patient care, would you use it?"<br>Response: "I probably would. Patient care is important to me."<br>Interviewer: "Would it matter how easy it is to use?"<br>Response: "Probably not. Since I'm in this job to help patients, there are a lot of things that we do that isn't easy to do but we do it anyway." |
| Interviewer: "If you couldn't find another way to do something that your PDA did the best and improved how you cared for your patients, improved the quality of patient care, would you use the PDA even it were hard to use.<br>Response: "If I could do it any other way?"<br>Interviewer: "Correct."<br>Response: "I would use it. I wouldn't care as much about how easy the PDA is to use if it really did help me in my practice. |

shows that there are several characteristics of physicians and their environments that cause TAM's prediction that perceived ease of use influences perceived usefulness to be incorrect (e.g., facilitating conditions, substitutes to technology).

The second question is "What, if any, characteristics of physicians and their environments contribute to physicians' use and non-use of PDAs?" This question also inquires about physician and environmental characteristics and this section looks at the perceived ease of use construct, as well as physician, environmental, and PDA characteristics.

### 6.1.1. Perceived Ease of Use Construct

Once the data was collected and analyzed, the research question regarding perceived ease of use was answerable. The results of the analysis suggest that physicians want to improve patient care. This fact was stated by a majority of the interviewed physicians. These interviewees indicated that doctors are in the business of helping patients. The analysis further shows that physicians are adamant in their dedication to delivering quality care. They indicated that the PDA's easiness is not an antecedent to whether the technology is useful, or is used. As is shown in Table 16, the data indicates that the physicians who took part in this study are less concerned about how easy a technology is to use if it ultimately improves quality care. One physician used an analogy of using a blood pressure cuff and its difficulty of use: "Take this blood pressure cuff. It can be a pain but the electronic ones aren't accurate so most of us still use the cuff and stethoscope."

| Table 17 – PDA User Characteristics |
| --- |
| Useful to have shirts with pockets |
| Willingness to hot synchronize PDA regularly |
| Reluctance to upgrade (due to probability of a glitch) |
| Male sees the PDA as "fun" and/or "cool" |
| Likes technology |

### 6.1.2. Physician Characteristics

In investigating the characteristics of physicians several interesting data were obtained that suggest the use and non-use of technology. Several of the characteristics that were gathered from the subjects are presented for PDA users and PDA non-users in Table 17 and Table 18, respectively.

| Table 18 – PDA Non-User Characteristics |
| --- |
| Don't want to be too accessible (caused by email capabilities of a PDA) |
| Intimidated |
| Ornery |
| Don't wear white coats with pockets |
| Like to see everything on one page |
| Don't like to receive just a summary (may miss something) |
| Not an organized person |
| Resistant |
| Reluctant to use based on generational stands in health care |

### 6.1.3. Environment Characteristics

As is shown in Table 19, there are varied environment characteristics that the participants noted. Each extract is referenced with a letter which indicates which interviewee made the comment (e.g., Interviewee A said, "We technically don't do e-mail officially because of security concerns."). The second column, titled Summary, is a synopsis of the characteristics which are shown to its left in column 1.

### 6.1.4. Technology Characteristics

As is shown in Table 20, the interviewees identified several positive and negative characteristics on the PDA.

## 6.2. Limitations of this Research

As is generally accepted in the research community, there is not any research that exists that does not have limitations – this research included. Therefore, the most relevant limitations of generalizability and lack of testing are presented as the major limitations to this case study.

### 6.2.1. Generalizability

Generalizability is the plausibility of extending the research beyond the immediate case study (e.g., other settings, at a different time). External validity is another

**Table 19 – Environment Characteristics**

| - Text Extracts | Summary |
|---|---|
| - A: We technically don't do e-mail officially because of security concerns.<br>- F: I have some that do e-mail, but we're not supposed to respond.<br>- G: …although the e-mail communication doesn't usually include patient advice or discussion of symptoms. Even if a student contacts me by e-mail and asks for advice or health information, I usually advise via the e-mail, you know, make an appointment with me or call me. So, rarely is that used to convey, again, for HIPAA reasons, used to convey any medical advice.<br>- | Limitations to technology used because of security concerns |
| - A:…we don't have a computer in each room.<br>- F: …we have enough computers in the hospital so that if you need to go and look up a quick reference, then you can go to a computer within the hospital system rather than having it in your pocket.<br>- G: No, we do not have them [computers] in patient rooms, but they're out in the nurses' stations, our office, clinics. Each clinic office now has their own computer.<br>- H: You know, like on these computers we have them up in the wards and in here and in the patient rooms and you can pull up the Serna system on them and get the patient data.<br>- H: I don't feel like they're any better on there [PDA] instead of having them here [PC], 'cause we do have these in all the [patient] rooms… | Accessibility of technology |
| - B: Would you think that would help a little bit on the use if someone was able to set things up for you?<br>- G: Baseline training would help the resistance a little bit. | Support |
| - E: Ref: employee email - There's no policy. | Policy |

**Table 20 – Characteristics of the Technology:**

| |
|---|
| *Positive Characteristics* |
| Provides for quicker access to information (versus PC or book) |
| Handy |
| Allows text searches to support personal memory (only remember first name) |
| Fun |
| Instant Gratification |
| Lightweight |
| Large storage capacities |
| Ability to use storage (memory) cards for nearly infinite storage space |
| Multi purpose devices: Organizer, Phone, Pager |
| Fits in your pocket |
| *Negative Characteristics* |
| Middle of the road model costs about $200 - $250 |
| Slides out of pocket easily (possibly causing damage) |
| Some have proprietary writing system |
| Transferring to a new model is unreliable (data loss, corruption, jumbled categories) |
| Combination models are not as full featured as individual devices (phone, organizer, and pager) |

term for generalizability. As was stated earlier, Lee and Baskerville (2003) assert that generalizing case study research theories is not any more difficult than generalizing theory that is derived quantitatively. These authors state that in quantitative research, "An increase in sample size is beneficial, but the benefits take the form of improved *reliability*

*of the sampling procedure*, rather than improved *generalizability of a sample to its population*" (2003, p. 226).

Additionally Yin (2003) informs us that a case study is externally valid if it is generalizable beyond the immediate case study. External validity is obtained by "establishing the domain to which a study's findings can be generalized" (p. 34) and he asserts that the externally valid criterion is most easily satisfied by conducting multiple case studies (pp. 33 and 35). Yin does not mean that there must be multiple case studies in order for the findings to be externally valid. Yin asserts that with case studies, this generalization is analytical – not statistical as it is in other forms of research, and case studies should aim for analytical generalization. In analytical generalization, the researcher's goal is to generalize a specific set of results to some broader theory (Yin 1994, p.36). In this case, the broader theory is PTAM. However, the study would increase its external validity if multiple cases were used.

### 6.2.2. Testing

The goal of this research was to produce a plausible theory that would better explain a physician's behavioral intention to use technology. However, while a plausible theory was introduced, it was not tested. A theory must be empirically validated. Therefore, this is a limitation of this study and the propositions and PTAM should be tested in an organizational environment to corroborate the theory. This implies that this research should be the beginning of further research.

## 6.3. Contributions to Research and Practice

Technology acceptance has been a subject that has been researched for many years. However, as we have investigated health care, and specifically physicians' use of technology, these current theories have failed to accurately predict usage. PTAM is a step to begin to understand these contrary phenomena. It also should be used as an exemplar where the process of rebuilding technology acceptance research in other health care environments (e.g., nursing, hospital administration) and other industries (e.g., manufacturing, travel, education).

This research also shows how qualitative research can inform research that has been traditionally done quantitatively. What should be taken from this presentation is that the goal of this investigation is not to discredit research that is done using quantitative methods, but the reason for its presentation is to observe the subject from another perspective. This different view allows for additional information to be captured that was not ascertained using traditional methods. PTAM offers an additional view that expands our knowledge of technology acceptance in the health care industry.

Physicians have indicated in this study that improving patient care is important to them. It is unfortunate that the use of technology by physicians is lacking (Wiley-Patton 2002). This research begins to look closer at why physicians have not used technologies as readily as other professionals. While the traditional technology acceptance models look at ease of use as a determinate (directly and indirectly) of the behavioral intention to use technology, this research posits that ease of use by physicians is negligible. Therefore, technology developers who wish to have their technologies adopted by

physicians should focus less on the ease of use of their products and more on its applicability to increasing quality care of patients.

PTAM includes perceived substitutability and facilitating conditions as variables. While facilitating conditions has been offered as a construct in acceptance models in the past, substitutability has been absent. Therefore, health care organization should thoroughly be cognizant of what they make available to physicians. If it is the organization's desire to increase the use of specific technologies, then PTAM indicates that they should limit alternate sources.

### 6.4. Future Research

There are several angles that future research can take. These possibilities include discovering the applicability of qualitative research in other heath care areas such as nursing, hospital administration, and health care staff. Future research can also expand beyond health care and other industries can by examined to determine the applicability of similar models.

As was mentioned in Section 5.3 and in Table 14 on page 131, there are several studies which showed that TAM or the Extended TAM failed to purport relationships as predicted. Future research was suggested in order to apply this model or another model to obtain a comparison with the relative findings. This research was conducted to present an additional view of phenomena that was not possible using quantitative methods. Similarly, using quantitative methods, PTAM can be further developed and tested.

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# Appendices

# Appendix A
# Measurement Scales for Perceived Usefulness and Perceived Ease of Use

## Perceived Usefulness Scale

**Using CHART-MASTER in my job would enable me to accomplish tasks more quickly.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**Using CHART-MASTER would improve my job performance.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**Using CHART-MASTER in my job would increase my productivity.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**Using CHART-MASTER would enhance my effectiveness on the job.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**Using CHART-MASTER would make it easier to do my job.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**I would find CHART-MASTER useful in my job.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

## Perceived Ease of Use Scale

**Learning to operate CHART-MASTER would be easy for me.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**I would find it easy to get CHART-MASTER to do what I want it to do.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**My interaction with CHART-MASTER would be clear and understandable.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely

extremely quite slightly neither slightly quite extremely

**I would find CHART-MASTER to be flexible to interact with.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**It would be easy for me to become skillful at using CHART-MASTER.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

**I would find CHART-MASTER easy to use.**

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

# Appendix B
# Marketing Letter

I am requesting your assistance in completing my Ph.D. in Business, concentration Information Systems, this year. I am a student at VCU and I am interviewing physicians on their use and non-use of technology. While your participation in my research study is completely optional, I hope that you would be so inclined to help me.

I would like to schedule, at maximum, 45 minutes of your time to conduct an interview on your use or non-use of Personal Digital Assistants (PDAs) for patient care (see attached examples of PDAs). The interview will be digitally recorded and the information will be used to assist me in my dissertation research. I have attached an outline of the interview. All of your responses will be kept in strict confidence and your name will never be used in the study.

Thank you very much in advance.

Kindest Regards,

Jon Blue
Ph.D. Candidate
Virginia Commonwealth University
School of Business
Department of Information Systems

**Personal Digital Assistant (PDA) Acceptance Semi-Structured Instrument Outline**

I. Types of Patient contacts

II. Use of other technologies personally and professionally

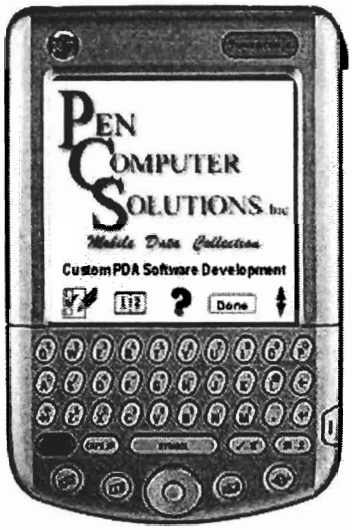
III. Personal Definition of Technology

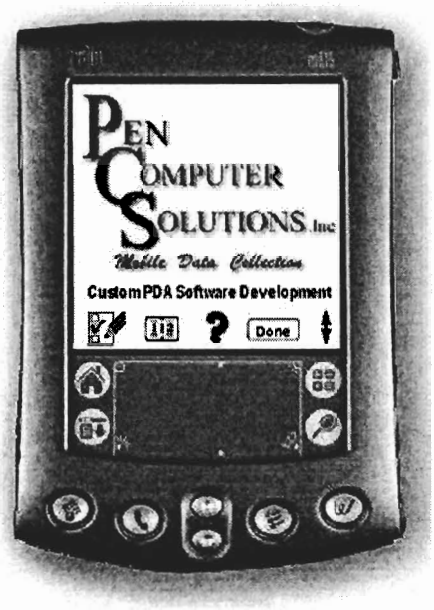
IV. Current Use / Non-Use of PDA

V. Ease of Use / Non-Use

VI. Intention to Use / Non-Use

**Examples of PDAs**


PEN
COMPUTER
SOLUTIONS Inc
Mobile Data Collection
Custom PDA Software Development
Done


PEN
COMPUTER
SOLUTIONS Inc
Mobile Data Collection
Custom PDA Software Development
Done

# Appendix C
# Pre-Interview Information

**Medical Degree Information:**

**Year received M.D.** _____

**Institution degree received:** _____

**Institution Location:** _____

**Board Certification(s):** _____

_____

_____

**Medical Specialties (if any):** _____

_____

_____

**Other:** _____

_____

**Current Main Focus of Practice (if any)**

_____

**Other Degree Information:**

1. **Degree / Major:** _____ / _____

   **Year received:** _____

**Institution degree received:** _____

**Institution Location:** _____

2. **Degree / Major:** _____ / _____

**Year received:** _____

**Institution degree received:** _____

**Institution Location:** _____

3. **Degree / Major:** _____ / _____

**Year received:** _____

**Institution degree received:** _____

**Institution Location:** _____

**How would you rate your computer skills?**

**Circle One: High / Medium / Low**

**Year of Birth** _____

**Country of Birth** _____

**Race** _____

**Gender** _____

# Appendix D
# Physician's TAM Instrument

**Interviewee# _____**

**Personal Digital Assistant (PDA) Acceptance Semi-Structured Instrument**

What other means do you use to communicate with your patients outside of 1-on-1 contact?

What % of your communiqué to your patients is via each type?

Do you use email personally, professionally, or both?

If yes:

Approximately how much time do you spend on email each week?

Personally? Number of emails received?

Professionally? Number of emails received?

Do you use a cell phone?

What other forms of technology do you use?

Personally?

Professionally?

How do you define technology?

What is your familiarity with the use of the PDA in the health care field?

What are some of the uses of the PDA in health care field that you are aware of?

Do you have a PDA?

Do you currently using a PDA? Y / N

<u>If currently using a PDA:</u>

What do you use a PDA for?

Personally?

If yes: How much do you use a PDA? – number of hours per week

How long have you used it?

What kind of PDA do you use?

Professionally?

If yes, how much do you use a PDA? – number of hours per week

How long have you used it?

What kind of PDA do you use?

Do you find the PDA easy to use?

Why or Why not?

What are the characteristics of the PDA that you enjoy most?

Environmental, training, PDA characteristics, results of using a PDA.

What changes to the PDA would make the PDA more useful?

Do you believe that using a PDA is confusing?

Why or why not?

Do you believe that using a PDA is frustrating?

Why or why not?

Do you believe that using a PDA is cumbersome?

Why or why not?

Do you believe that interacting with your PDA is clear and understandable?

Why or why not?

Do you believe that you find it easy to get your PDA to do what you want it to do?

Why or why not?

Do you believe that interacting with the PDA requires a lot of your mental effort?

Why or why not?

Do you always try to use your PDA to do a task whenever it has a feature to help you perform it?

Why or why not?

Do you always try to use your PDA in as many cases / occasions as possible?

Why or why not?

Do you intend to continue using your PDA in the future?

Why or why not?

Do you think that it would be very good to use your PDA for patient care in addition to traditional methods?

Why or why not?

If currently not using a PDA:

Have you previously used a PDA?

Professionally: Y / N,

If yes:

For what purpose and for how long?

Why did you stop using a PDA?

Personally: Y / N

If yes:

For what purpose and for how long?

Why did you stop using a PDA?

What, if anything, would make you use a PDA:

Personally?

Professionally?

(prompts: Environmental, training, PDA changes, personally)

Do you believe that using a PDA would be confusing?

Why or why not?

If you chose to use a PDA, do you believe that using a PDA would be frustrating?

Why or why not?

If you chose to use a PDA, do you believe that using a PDA would be

cumbersome?

Why or why not?

If you chose to use a PDA, do you believe interacting with the PDA would be clear and understandable?

Why or why not?

If you chose to use a PDA, do you believe you would find it easy to get the PDA to do what you want it to do?

Why or why not?

If you chose to use a PDA, do you believe that interacting with the PDA would not require a lot of your mental effort?

Why or why not?

Do you think that it would be very good to use your PDA for patient care in addition to traditional methods?

Why or why not?

Do you know others that use a PDA and if so how do they use it. Is this a personal or professional acquaintance?

Would you like to change or modify any of your responses you have made today?

What other thoughts or comments do you have?

# Appendix E
# Research Synopsis

## I. Title

Rebuilding Theories of Technology Acceptance: A Qualitative Case Study of Physicians' Acceptance of Technology

## II. Investigators

Principal: Allen S. Lee

Student Investigator: Jon T. Blue

## III. Conflict of Interest

Not Applicable (N/A)

## IV. Hypothesis

*Problem*: A well known information systems theory, the *Technology Acceptance Model*, has repeatedly failed to accurately predict a physicians' behavioral intention to use technology.

*Background*: Most studies that have applied the Technology Acceptance Model and its variants fully support the expectations that are purported by the model. However, there have been empirical findings in several environments that have not confirmed the Technology Acceptance Model's suggested relationships – one such industry is health care. Legris et al. (2003) offers a critical review of the technology acceptance model and show eleven studies

that have either a non-significant or reverse relationship of what the Technology Acceptance Model predicts will occur.

*Importance of Research*: Information technology applications are abundantly present in the health care industry. However, even though physicians have indicated that information technology in health care is not only desired but needed (HIMSS Survey 2005), the use of technology among physicians is less that expected (Wiley-Patton 2002). The HIMSS 2005 survey indicates that increasing patient's safety/reducing medical errors is the most important health care issue today. Additionally the survey reveals that this issue is among the top business issues that will affect health care in the future. The most important future technology as stated by the survey respondents is implementing an electronic medical records system. Oddly, only 18% of the survey respondents currently use an electronic medical records system.

Even with a lack of technology acceptance and use in heath care, overall technology acceptance is heavily researched. The Social Science Citation Index (SSCI) reports that Davis' technology acceptance articles have been referenced over 1200 times since 1989. This number does not include the multitude of studies that use the Technology Acceptance Model as a basis and extend, refute, or verify the model. Additionally researchers have investigated and empirically tested the Technology Acceptance Model in various ways which encompass different industries, different cultures, and different applications (e.g., Al-Gahtani 2001; Amoako-Gyampah et al. 2004; Hu et al.

1999a) in attempts to corroborate the model's predictive ability. In most of these studies, the Technology Acceptance Model sufficiently predicts an end-user's behavioral intention to use a technology. However as stated, the predictive ability of technology acceptance in the health care industry has been less successful.

*Goals of Proposed Study:* This study will build on the current theories of technology acceptance by studying physician environments and explaining physicians' behavioral intention to use technology. This will be done by using a qualitative case study methodology.

**Specific Aims**

It is projected that this investigation will present plausible theories that will offer equal if not greater explanatory power than the current technology acceptance theories. This will occur because the resultant propositions from the case study approach will provide complementary explanations to those provided by theories that have resulted from the more widely used quantitative research methods. The results will also present several plausible reasons why a model that can explain over 50% of the variance in many industries is not equally predictive in a health care environment.

## V. Background and Significance

The seminal *Technology Acceptance Model* (the Technology Acceptance Model) (Davis 1986; Davis et al. 1989; Goodhue et al. 1995) is a motivational model of the end-user to predict information technology utilization. the

Technology Acceptance Model is an adaptation of the *Theory of Reasoned Action Model* (the Theory of Reasoned Action) to facilitate the study of information technology usage (Ajzen et al. 1980; Fishbein et al. 1980). A successor to the Theory of Reasoned Action is *the Theory of Planned Behavior*. Both the Theory of Reasoned Action and the Theory of Planned Behavior have been used extensively to study specific behaviors (Ajzen 1985). The Theory of Reasoned Action and the Technology Acceptance Model posit that a behavior is determined by the intention to perform the behavior. It has been found that actual behavior and intention are highly correlated (Davis 1986; Fishbein et al. 1980). Davis (1986) looked at the exogenous variables that influence one's attitude toward information technology use. The Technology Acceptance Model prescribes *perceived ease of use*, and *perceived usefulness* as the independent variables. Additionally, *perceived ease of use* influences *perceived usefulness*. In the Technology Acceptance Model, behavior is voluntary and completely at the discretion of the human agent. Davis' (1986) goal was to develop and test a theoretical model of the effect of system characteristics on a user's acceptance of information systems. the Technology Acceptance Model was developed with the objectives of 1) providing the theoretical basis for a practical user acceptance testing methodology to assist system implementers and designers a priori development and 2) to improve the understanding of user acceptance processes by providing new theoretical insights into the successful

implementation and design of information systems. As a stalwart model, the Technology Acceptance Model has been widely applied and tested in numerous studies (e.g., Adams et al. 1992; Davis et al. 1989; Mathieson 1991; Straub et al. 1997).

In 2000, Venkatesh and Davis developed and tested a theoretical extension to the Technology Acceptance Model known as the *Extended Technology Acceptance Model.* The extended model includes several additional determinants of perceived usefulness. The model still purports that perceived ease of use both moderates perceived usefulness and influences the behavior to adopt. Even with the Technology Acceptance Model based on the Theory of Reasoned Action, Davis (1989) did not include social norm as a part of the original model. In the Extended Technology Acceptance Model social norm is operationalized as the perception of an individual that most people who are important to him think that he should or should not perform the specific behavior (Fishbein et al. 1975, p. 302).

The Extended Technology Acceptance Model purportedly explains usage intentions and perceived usefulness in terms of cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) and social influence (subjective norm, image, and voluntariness). This extended model was tested using longitudinal data that was collected in regards to four different systems in four different organizations - two voluntary usage sites and two mandatory usage sites. Measurements were

taken twelve times (three times at each of the four sites). The Extended Technology Acceptance Model was supported for all four sites at all times of measurement and explained 34% - 52% of the variance in usefulness perceptions and 40% - 60% of the variance in usage intentions. Venkatesh and Davis (2000) found that cognitive instrumental processes and social influence processes influenced user acceptance.

Venkatesh and Davis (2000) found that the Extended Technology Acceptance Model extends the Technology Acceptance Model by showing that subjective norm has a significant effect on the intention to use technology. This effect is over and above *perceived ease of use* and *perceived usefulness* for mandatory (not voluntary) systems (Venkatesh et al. 2000, p. 198).

Published research dealing with the health care industry and technology acceptance shows that study in this area is scarce – only six such articles surface. Hu, Sheng and Tam (1999a) research physicians' acceptance of telemedicine in Hong Kong using the Theory of Planned Behavior (Ajzen 1991). These authors summarize their results by indicating that the Technology Acceptance Model does not fit well with physicians. Dixon and Stewart (2000) present an instrument that was adapted from the Technology Acceptance Model that is tested on 101 family care physicians to stratify physicians into high, intermediate, and low information technology usage groups. This research does not include the Extended Technology Acceptance

Model. Hu, Chau and Sheng (2002) use as a theoretical basis, a framework proposed by Tornatzy and Fleisher (1990) to develop a research model for targeted technology adoption and empirically evaluate it in a survey study that involves most Hong Kong public health care organizations. Chau and Hu (2002b) compare the original Technology Acceptance Model, the Theory of Planned Behavior, and a model combining the two models, to explain technology acceptance decisions by physicians. They discovered that the Technology Acceptance Model was more applicable than the Theory of Planned Behavior, or the combined model in this situation. The only health care research that has tested the Extended Technology Acceptance Model, are the studies conducted by Chismar and Wiley-Patton (2002; 2003) and Wiley-Patton (2002) which looks at pediatricians' acceptance of using the internet. Their results only partially confirm the Extended Technology Acceptance Model and significant theoretical aspects are not supported. In their study, perceived ease of use does not predict intention to use. Additionally, perceived ease of use is not a determinate of perceived usefulness. Other variables of the Extended Technology Acceptance Model that were discovered to be non-significant are subjective norm, image, and result demonstrability. All of these studies have been conducted using quantitative positivist methodological approaches.

## VI. Preliminary Progress / Data Report

None

## VII. Research Method & Design

*Research Method* - This study is qualitative and will use a positivist case study research approach as specified by Yin (1994) and will use the "natural science model" of empirical inquiry using the rules of hypothetico-deductive logic as presented by Lee (Lee 1989a; 1989b). Additionally, in order to build on current technology acceptance theories, several grounded theory techniques as suggested by Strauss and Corbin (1998) will be used. The resultant plausible theoretical propositions will satisfy the four positivist requirements of 1) falsifiability -- a possibility exists that the theory can be proven untrue, 2) logical consistency -- the predictions that the theory produces do not contradict one another, 3) relative predictive power -- stands equal to or surpasses other known competing theories, and 4) survival -- all attempts to show a theory falsifiable have failed (Lee, 1991, pp. 343-344 and pp. 346-347).

*Design* - The Journal of Mobile Informatics (2005) indicates that mobile computing is the next technology frontier for health care providers. Personal data assistants (PDAs) are used throughout the health care industry for such tasks as accessing medical literature, pharmacopoeias, medical education, patient tracking, research, scheduling, e-prescribing, patient confidentiality, business management and costs (Fischer et al. 2003). Additionally, data capture and retrieval using PDA technology by nurses, allied health care professionals, and physicians are improving efficiency and enhancing patient

care. Current applications primarily run under the two leading PDA operating systems, PALM OS® and Windows CE®. The concept of a PDA, running health care applications will be the technology used in this case study.

Study Participants. Using a grounded theory approach, data will be collected from the study participants via semi-structured interviews and their voice digitally recorded. The audio recordings will be transcribed by a 3rd party.

*Number of Study Participants Planned*

There have been eight (8) Virginia Commonwealth University physicians that have been identified to be invited to take part in the study. The physicians that will be invited to participate in the case study are employees of the VCU Health System and the VCU Student Health organizations. Using techniques from the grounded theory methodology, data from each interview will be codified and categorized as it occurs. The expectation is that by the fifth interview, new categories will cease to emerge. Conservatively, additional interviews, up to a maximum of eight, will be conducted, and the data from these interviews will be categorized to ensure that they are not producing additional categories.

*Designing the case study.* In completing the case study design, Yin (p. 32) indicates that the design should have the components of: 1) a study's questions, 2) its propositions (if any), 3) its units of analysis, 4) the logic linking the data to the propositions, and 5) the criteria for interpreting the findings. Propositions will be discovered, as data is analyzed and synthesized.

The unit of analysis is the physician, who is in an organizational setting. The logic linking the data to the propositions and the criteria for interpreting the findings will be based on the natural science model of social science research using hypothetico-deductive logic.

Yin (1994) states that the research design should be based on the "logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions." However, subsequent to designing the case study is preparing for data collection, collecting the data, analyzing the data and presenting the results of the study. This research will follow the steps that are identified by Yin (1994).

*Instrument Development*. An instrument has been developed for the semi-structured interviews that will assist in understanding physicians' behavioral intention to use the PDA in their health care practice (instrument attached). The interview tool primarily contains open-ended questions. To increase construct validity, the instrument questions have been presented to three health care professionals who work in a physician's office. They were asked to assess the instrument's ability to gather data that will assist in answering the research questions. Similarly, feedback was sought from information systems Ph.D. students and they were asked to assess the instrument and provide feedback.

## VIII. Statistical Analysis

This study is qualitative (not quantitative) and no statistical analysis will be done. However, a major part of analyzing the captured data will be the codification process. Coding is the point where theory begins to emerge. Three processes, that often overlap, are involved in the analysis from which sampling procedures are derived. These processes are open coding, where data is broken open to identify relevant categories; axial coding, where categories are refined, developed and related; and selective coding, where the core category, or central category that ties all other categories in the theory together, is determined and related to other categories (Strauss et al. 1998, p. 98).

## IX. Data And Safety Monitoring

Not Applicable – This research does not involve greater than minimal risk.

## X. Human Subjects Instructions

### A. Description:

Physicians will be interviewed for this study. The interviews will take place on VCU property on the Academic Campus (specifically the VCU Student Health Center, the VCU Virginia Mechanics Institute Building (VMI) Building, and the VCU Hospital.

The physicians must be medical doctors who interact with patients. There is not a limiting requirement of the physician's age, race, gender, or sexual orientation. Nor is there a requirement that the physician uses, or

has used technology personally or professionally. This group of individuals (physicians) was chosen because this research is attempting to expand on existing theories of technology acceptance in a health care environment. Earlier quantitative studies failed to appropriately predict physician's intention to adopt technology.

There will not be any VCU students that will be included in the study. As described in Section VIII (Research Method & Design), this research does not have an a priori number of participants. Participants will be contacted and interviewed as additional data is needed.

There will not be any special cases of subjects except that the subjects must be practicing physicians.

**Research Material:**

Material obtained from physicians during this research will be digital audio that will be transcribed.

After the interviews are digitally recorded, the recording device will be in the personal possession of the student investigator. Immediately following the semi-structured interview, the student investigator will upload the recording to a notebook computer that is password protected and accessible only by the student investigator. The digital file will then be permanently erased from the digital recording device. The information from the demographic sheet that is filled out by the interviewee will be inputted onto the same notebook and the sheet will be shredded.

**B. Recruitment Plan:**

In that the only requirement for participation for this study is that the participant must possess a medical degree, potential participants will be identified by the researchers' knowledge of persons who have a M.D. Additionally, the researchers will ask the interviewees if they know other physicians who may agree to participate in the research.

An invitation to participate in the study will be done via email. The preliminary invitation document will have a short statement asking for their participation. Attached to the email will be an outline of the semi-structured interview topics. The participants will be told that their participation is optional and that if they choose to participate, their responses will be confidential (email example attached).

If the potential participant agrees to participate then an interview will be scheduled via email. They will receive a copy of the *Informed Consent Document* and the *Demographic Questionnaire.* They will be asked to complete the questionnaire prior to the interview and have it available for the researcher at the scheduled interview. They will also be asked to review the *Informed Consent Document* prior to the scheduled interview.

At the scheduled interview the researcher will ask the participant if they have any questions and the researcher will ask the participant to sign the *Informed Consent Document.* The researcher will witness the

participant's signature and provide a signed copy to the participant at the time of the interview.

**C. Potential Risks:**

The only risks with this study involve the possibility that some persons might consider some of the questions sensitive. There is no physical component to this research, so there is minimal risk of physical injury.

**D. Risk reduction:**

To reduce the risk of possible identification of individual responses to questions on the questionnaire and from the semi-structured interview, each participant will receive a participant number. Individual names will not be identified on the collected data nor will the digitally recorded interview include their name.

The digitally recorded interview will be transcribed by either the interviewing researcher or using a third party who will not be connected with the study.

**E. Risk/Benefit:**

There are no direct benefits; except that once the interview is complete the participant can receive a digital and/or hard copy of the interview.

**F. Compensation Plan:**

Not applicable – There will not be any compensation for participation in this research.

**G. Consent Issues:**

1. **Consent Setting**

   The researcher will send to the participant, via email, a consent document prior to the scheduled interview. This will occur at minimum 48 hours before the interview. The document will be signed at the scheduled interview and the participant will be given the opportunity to opt-out of the research. They will be given as much time as they would like to sign the *Informed Consent Document.*

2. **Comprehension** – Not applicable.
3. **Special Consent Provisions** – Not applicable
4. **ASSENT PROCESS for children** – Not applicable
5. **Waive the Requirement to obtain prospective assent** - No request
6. **Waive the Requirement to obtain Prospective informed consent** - No request
7. **Issues pertaining to Genetic Testing** – Not Applicable – no genetic testing
   a. **Future contact concerning further genetic testing research** – Not Applicable
   b. **Future contact concerning genetic testing results** – Not Applicable
   c. **Withdrawal of Genetic Testing Consent** – Not Applicable

d. **Genetic Testing Involving Children or Decisionally Impaired Subjects** – Not Applicable

e. **Confidentiality** – Not Applicable

# Appendix F
# Extracted Phenomena from Interviews

| Phenomenon | % of text lines | # of Respondents (out of 8 total) |
|---|---|---|
| • Physicians are aware of PDA use and capabilities in health care | 4.00% | 8 |
| • Physicians used PDA substitutes to assist them in delivering care to patients. | 3.20% | 7 |
| • Physicians who use/used a PDA primarily use the PDA for drug information. | 2.90% | 5 |
| • Physicians at VCU are dissuaded from using some forms of technology because of organizational security concerns and policy. | 2.30% | 6 |
| • Physicians find the PDA easy to use. | 2.00% | 6 |
| • If the PDA improved patient care then they would use it. | 2.00% | 8 |
| • PDA use is quick, handy, convenient, and accessible. | 1.70% | 3 |

| | | |
|---|---|---|
| • Physicians who use/used a PDA hot synchronize their PDA regularly to keep it up to date | 1.40% | 5 |
| • Physicians that do not use a PDA have to be convinced that using one would save them time. | 0.88% | 2 |
| • Physicians who do not use a PDA are not organized. | 0.75% | 2 |
| • Physicians think that the PDA would help in administrative duties like billing/coding/letter writing. | 0.72% | 4 |
| • If support were more readily available, PDA use would improve. | 0.69% | 2 |
| • Although physicians have access to other sources to assist in delivering care, if they own and use a PDA, they use it first | 0.63% | 3 |
| • People that do not use a PDA do not feel that they would ever have a use for one in their personal lives. | 0.63% | 3 |
| • There is a generation gap in use/non-use of technology | 0.63% | 3 |
| • Physicians who do not use a PDA have not seen the benefits out weigh the effort to learn/use it. | 0.54% | 3 |
| • Physicians who use/used a PDA want to keep it. | 0.51% | 3 |
| • Physicians who don't use a PDA know they can | 0.51% | 3 |

| | | |
|---|---|---|
| learn it. | | |
| • PDA's are temperamental devices | 0.42% | 2 |
| • Physicians like having separate tools e.g., PDA, cell phone, pager | 0.39% | 1 |
| • Physicians who do not use the PDA do not like the ergonomics of the device. | 0.36% | 2 |
| • Previous PDA users stopped using the PDA when the batteries ran out. | 0.33% | 2 |
| • Physicians who do not use a PDA find it inconvenient to carry | 0.30% | 2 |
| • Physicians that don't use a PDA do not want to be accessible. | 0.15% | 1 |
| • Physicians find the PDA easier to use when they don't have a computer in the patient room. | 0.12% | 1 |
| • Even though physicians know they are smart, the PDA non-users find it intimidating. | 0.12% | 1 |
| • Physicians that do not use the PDA think they may lose it. | 0.12% | 1 |
| • Social Norm | 0.12% | 1 |
| • Physicians like to have current information | 0.09% | 1 |
| • Physicians who stopped using the PDA do not miss | 0.03% | 1 |

| | | |
|---|---|---|
| it. | | |

# Appendix G
# Interview Transcripts

+++ ON-LINE DOCUMENT: ABlue-Interview 2-DS330013
Interviewee 012
[ABlue-Interview 2-DS330013 : 1 - 356 ]
Jon Blue
Interview Audio File: DS330013
**Jon:** I will go through a list of questions and it's pretty semi-structured, so just kinda talk freely. There's a few yes and no, but then I'll probably ask you to follow-up on a few things as well.
**Male:** Okay.
**Jon:** The first question is, what forms of communication do you use to communicate with your patients, other than one-on-one? Do you use any other forms of communications?
**Male:** Rarely. Usually it's just one-on-one. But occasionally do talk on the phone. But that's either initiated by the patient if they have a question, or by us if there's some follow-up that they need for lab tests. Sometimes we'll talk about that over the phone. E-mail? We technically don't do e-mail officially because of security concerns. Occasionally, folks will contact us by e-mail and we'll respond. Some limited contact by e-mail, but we generally don't do ongoing contact that way. I think the future would be to get a secured server where we could do that.
**Jon:** And so when you say by phone, if you were say, just generally in a week, what percentage of your time would you say you do by phone versus one-on-one?
**Male:** It's a small percentage. I don't know if it would be maybe 3 to 4 phone calls a day or something like that. It's hard to get a percentage in my head. Probably about 10% of something.
**Jon:** Okay.
**Male:** About 5 to 10 percent.
**Jon:** Great. I know you use e-mail, so do you use e-mail personally, professionally, both.
**Male:** Initially you asked me about communication with patients. We use e-mail for other communication, you know, with other staff members. Seems like a barrage of e-mail that we go but a lot of its junk mail, of course. We also get a number of e-mail from the university, from the

medical center, you know, from other sources, too.
**Jon:** So, how much time per week would you say that you spend on e-mail? Or how much time?
**Male:** Well, I have business e-mail and then there's private e-mail, too. I guess it averages out to 23 minutes a day, something like that.
**Jon:** And that's for both personal and private?
**Male:** Maybe 15 minutes a day each, something like that, on average. Sometimes I don't get to it and other days I do.
**Jon:** Do you use a cell phone at all?
**Male:** I have a cell phone, yes. I don't use that for business communication, but I try to just use that for private communications.
**Jon:** What other types of technologies do you use?
**Male:** Well, I know the study mentions PDA's. I use a PDA, but it's not for communication. It's more for information.
**Jon:** Okay. Use any other type of programs other than e-mail on the computer?
**Male:** On the computer, I use the word processing software.
**Jon:** And that's more personal or professionally?
**Male:** Some of both. But I do a fair bit professionally to type letters for patients and that.
**Jon:** Okay.
**Male:** And we're in a university setting, so they have letters regarding your academic status.
**Jon:** Now, when you think of technology, how do you define technology?
**Male:** Let's see if I can get a kind of accurate definition. But I think in terms of assistance or aids in sort of like beyond your own brain, to assist your own brain in being able to get jobs done or tasks accomplished. Most of the technology that I would use, again, since my field is, you know, a lot of it is information and processing information, the technology I use probably has a lot to do with processing information and communication, as opposed to a manufacturing technology, something that produces goods. We provide a service; we're not producing goods. So, it would be those types of technologies that I'm most familiar with.
**Jon:** Okay, great. What is your familiarity with PDA use in the healthcare environment? What do you know?
**Male:** I have one, so that's probably most of what I know is my own experience. I bought a PDA I believe 1998, so that gives me about 7, 8 years experience. Originally, I just used it for keeping track of phone number, a date book and memos. But I also have a program on it, which I've had for several years, probably at least 6 years, called Epocrates. I found it to be very helpful because it has a listing of medications and it's helped me 'cause it's updated, so I always feel like it's up-to-date, whereas a textbook wouldn't, gets out of date quickly. So, I

found that to be helpful, too. And I do use that probably every day or a few times a day.
**Jon:** So, anytime you need to look up a medication or something, you use-
[Both talking at once. ]
**Jon:** Okay. You usually go there first.
**Male:** Now, we have other sources, too. We have the books here in the offices. That's more exhaustive. I do prefer that, but much more likely to refer to the Epocrates in the PDA first. And we have drug references online. The Physician's Resource through the university medical center that's called Up-To-Date. And that is a medical database and it has information, different medical cases. And it also has a section on medications. So, I can type in a medication and get information on that as well.
**Jon:** Have you heard of other usages of the PDA for other applications of healthcare?
**Male:** I know it's used for-and I have not used it so much for equations, but I think in the hospital where they do calculations for drugs, they have to do special calculations for people with impaired kidney or liver functioning for certain drugs. Or if they're cancer or chemotherapy or things like that involve a lot of calculations. Even for kids based on weight. I don't see here kids here; they're all young adults or adults. So, I know there are other uses for it that way. There's like a body mass index they can get a calculation. I just have a formula. I probably would get that if I could pick that up easily. There's a limit, I guess, as far as memory, too, so. There's a lot of other programs out there that I've heard about, but none of them seem like things that I need.
**Jon:** You say you brought a PDA in '98. Have you had the same PDA or have you upgraded or done anything different to it, or are you using the same one?
**Male:** I think is the third one that I've had.
**Jon:** Same model or you kinda changed?
**Male:** Well, it's the model of where it's changed to. It's their standard model, so it's upgraded each time. So, I've sort of gone with like a standard or middle-of-road kind of model, not necessarily the absolute newest, because those are usually premium priced. So, middle of the road model that I can get for about 2, 250, something like that, or less.
**Jon:** So, you're using a PDA. Now, you talked a lot about within your profession. Personally, I think you said a little bit about names and addresses. So, do you use it in that aspect pretty much in-
**Male:** I use it as my address book, basically, and phone book. So, I found that to be very helpful. Every time I get a new number, I try to enter it. So, my wife sometimes will ask me, do you have the number for

so-and-so. And I can even be driving somewhere and I can pull it out and have it. You know, each relative. My relatives, her relatives. I always have it.

**Jon:** So, you keep it with you all the time.

**Male:** That's another thing I've found that I think it's most helpful if it's kept with one all the time. I know other folks they say they have PDA, but it's a drawer, they don't use it. They don't hot sink it. So, when I got it, I try to make a point of having it with me all the time. I got a little Velcro strap to keep it from slipping out of my pocket. I just wrap that around. So, if a bend over from the waist, it doesn't slide.

**Jon:** Wow.

**Male:** Now, if I bend over-I've dropped it a few times, not many. But it's only if I really bend over. If I just kind lean, it's not going to start sliding.

**Jon:** Oh, that's a nice little tool. I like that.

**Male:** So, I always have a shirt with a pocket. Not always, but 90% of the time, probably. So, I pick out shirts with pockets. If it's in my pants pocket, I fumble for it. I like to have it in my shirt pocket.

**Jon:** It's accessible. And so you use it maybe 2 or 3 times a day, you would say, with patients, you would say, average during the week?

**Male:** It would be more than that. Probably 4 or 5 times a day, I would think. Maybe more than that.

**Jon:** Three to five minutes each time sort looking up information.

**Male:** It's pretty quick. I can get the information I need in probably 30 seconds or a minute. So, I just go right to screen. It's very quick. And I can pull up what I need pretty quickly.

**Jon:** What type do you use?

**Male:** This is a Palm, which is the one I got originally in '98. So, it's a proprietary writing system. So, I'm not sure if it was transfer over. Maybe it would. I've just kept with that because I figure it's the safest. I've had a couple semi-disasters with losing information. And I think each time, with each unit, I've had something where I've lost a lot of data. Not with this one, I guess. But when I change over the new one, it jumbled the categories. So, ever since then, I've never gone through my-I probably have 1500 names. I haven't gone through all of them to re-categorize them. So, once I come across them, if they're not categorized right, I'll re-categorize them. But I lost about a third of my data early on, I think in the first year because of some glitz. And then I've had to do some hard resets on it a couple of times. But I've generally had the information hot synced.

**Jon:** So, that's what I was going to ask. Do you hot sink regularly?

**Male:** Over the years, over 7 or 8 years, sometimes I do and sometimes I don't. Right now, I'm in a hot-sink-regularly mode. So, I hot sink

probably every day and I do it from work because I have a link set up on the computer where it's easy to do.
**Jon:** Do you find it easy to use? You know, just the whole use of the PDA?
**Male:** Yes, I find it easy to use. It's pretty convenient. I think when I get in a routine of hot sinking, that's really pretty easy to use, too. But if it's been a long time, it takes longer to hot sync. If you do it every day, it's pretty quick. This longest is the drug info. That takes the longest time. Also because they have like little-Each time you hot sink, the Epocrates, they have information for you so you have to kind of respond to that whether you want to get a download or you don't. So, I feel sorta obligated like I should at least look at those to make sure I'm not missing something that I wanted. But it takes 30 seconds or something. It doesn't take very long unless you get into reading more. Probably 30 seconds or a minute just to review each time and click if I want to get it. And they will send them by e-mail, too.
**Jon:** That's a wireless unit that you're using now or is it actually one that you must synch with in order-
**Male:** It's not wireless.
**Jon:** Okay. So, if you think about the characteristics of a PDA, you know, whether or not their environmental, you know, results of using a PDA, what are the types of things that you like about it?
**Male:** I like that it's available quickly. It's probably the quickest. It's quicker than having to open a book. It's quicker that having to go down to my office. It's with me in the patient room. So, as far as patient care, I think it's a lot quicker. And it's handy. It's always available. Like I said, I can be in the car and I can hand it to a family member in the car, can you look up this number and call them. Or I can pull over and do it myself. So, it's always with me, so it's handy that way. So, I like that. The other thing is, I don't have to transfer it over. If I write something down by hand, you end up with a collection of paper and at some point have to enter it or do something with it or change it to a new sheet. But this, I don't have to. I put it in and I can draw it back out. I can search things, find things. I use that more, use the "find" function so that if I remember a name or part of a name, I can type that in and it pops up. So, it searches automatically for me. If I can think of part of it, if I have to look through a phone book or something, I wouldn't be able to find it probably. But since it's just names that I need, names that I've entered, then I can find things that way, too, with just a partial name or a last name.
**Jon:** Any other things that you think that you like?
**Male:** I don't know. It's fun, I guess. I enjoy it. I like being able to get that sort of instant gratification, I guess. I can call up information when I want it right away. I enjoy having that kind of efficiency from a time management point of view.

**Jon:** So, if you were to make any changes to the PDA to make it more useful for you, what are some of the things that you think you would do?
**Male:** Well, let's see. I have a friend who has one that is a cell phone. So, I've thought about that, having one that's integrated with the cell phone and that way you could just-When you have the number, you can just press call, so that would save a step. The problem I've found is there are limitations to these devices, too, and they do have a burp up information, or however you say it. They'll lose stuff. They're not 100%. They're not foolproof. So, having my phone and that together seems to add risk. If I'm using the phone, I'm using the PDA, that would seem to limit their life. And I realize every time you change over to a new device, you may lose something along the way. You may get a little hiccup and you lose or get information scrambled or something. So, if come to terms with having two devices because I feel like there are limitations. But just from a practical standpoint I can see there might be some advantages to having it all in one, 'cause those are the two devices I use probably the most. Every day I use those. I've see attachments that you can get to take pictures with them, too. And I thought about that at one point. Again, I'm kinda going the low-tech road. I feel like I like it the way it is. I'm kind of afraid of adding things 'cause I'm afraid it'll mess up what I have or it'll overwhelm. 'Cause it'll either overwhelm my memory or it'll cause some other glitch that'll make me lose information, or it'll somehow mess up the good thing I have going. So, I decided, get a digital camera. I'm pretty happy with it for what it does. And I don't think it necessarily needs to branch out into other functions at this point.
**Jon:** Right. Do you think it's confusing to use a PDA at all?
**Male:** Not at all.
**Jon:** Even from the very beginning?
**Male:** No. Well, I remember someone, actually a medical student, showing me their PDA before I bought one. And I was asking about, you know, is it difficult to do the shorthand language, because they use a shorthand called Graffiti with the operating system. And he was showing me no it's not. And he just whipped it out and ran off some characters and showed me how easy it was. I quickly learned that. The changeover with the new system, they have a second generation of Graffiti, so I had to learn that. That was a little-After learning the first one that was harder. And I must admit that I don't use the Graffiti as much now. I tend to use the keyboard more now because, for whatever reason, it's less likely to accept my Graffiti, my little hand-drawn characters. It's more likely to take me on the keyboard. I notice the error rate seems to be higher with the Graffiti 2, than it was with the Graffiti 1.
**Jon:** Right. Would you say it was cumbersome at all?
**Male:** I'm used to it. I mean, we have a joke that, you know, I'll hug

one of my daughters and they'll go, "Oh, Palm Pilot hug," 'cause they feel this Palm Pilot when I give 'em a squeeze. So, I guess in that respect, it's sort of a nuisance. But, other than that, and other than occasionally falling out of my pocket, it creates a little bit of a bulge, I guess. If I'm wearing a jacket, I tend to put it in the jacket pocket. But other than that, it's really pretty convenient. I don't even think about it most of the time. It's just there whenever I need it. So, I'm happy with the convenience of it.

**Jon:** What about the amount of mental effort it takes to use the PDA?

**Male:** It's minimal. It's easier to use a PDA than to use something else.

**Female:** So, to you, it's easier than going and getting online.

**Male:** It's definitely easier than having to go online because we don't have a computer in each room. It's easier than having to look it up in a textbook, as quick as that is. It's just easier to search. You don't have to pick up the bulky book. It's lightweight.

**Jon:** So, you try to use it anytime you can use it for what it does for you. You don't use other aspects. For what it does for you, it's the easiest to use, is what I mean.

**Male:** Right. It's the easiest to use. I go to that first before I go to other things.

**Jon:** So, do you think you'll ever give up the use of it?

**Male:** It's hard to imagine living without it. I would not volunteer to give it up. I would be unhappy if I were forced to give it up.

**Jon:** Okay. Let' see. Do you know of others that use the PDA?

**Male:** Yes.

**Jon:** And how are they using it? Are they using it pretty much the same as you? Are these people that are other physicians or are they just kind of person friends, or both? Could you tell me a little bit about-

**Male:** Yeah. I don't know a lot about how other people use it. I've had it all these years, but I've only had a few conversations with people and it's only been a few people. And generally, it's a few specific things or maybe some general comments. So, I'm not really sure how other people use theirs. But I know from going to meetings, they actually have had talks at medical meetings about use of them. So, I get some sense there about how they're used. It sounds like people use them pretty similarly. Some people are using more programs than I am. Some people are very into it and have a lot of programs on theirs. Some of the newer ones have larger memory capacities. People who use them in the hospitals use the programs a lot more, doing the calculations 'cause they need to. I just don't find that I need to. But people whose practices require more calculations I'm sure-If I had that type of practice, I would, too, use it more calculations and I'd get those programs. So, that would be one thing. I know a fellow outside of medicine. I know him from church. He's like a pharmaceutical sales rep. And he uses his all the time, too.

He was giving me tips. He mentioned about getting a screen that you could put on it. It's actually a little piece of like overhead transparency plastic cut to size. The first one that I had, I scratched up just from using the stylus. And he explained to me that you can get this transparency plastic, cut it to size, and then you can change those out. You can actually buy them commercially, too.

**Jon:** If you found the PDA difficult to use. Would you still use it if you found that using it would improve patient care?

**Male:** If it improved my patient's care I wouldn't really care if it were difficult. I use a lot of things that aren't easy to use. Take this blood pressure cuff. It can be a pain but the electronic ones aren't accurate so most of use still use the cuff and stethoscope.

**Jon:** You say that's Palm. Which model is that actually that you're using?

**Male:** It's a Tungsten E. I don't know if it's more to it than that. But it's Tungsten E.

**Jon:** Now, we're pretty much finished, but is there anything else that you think that you'd like to change or modify in your responses, or add to anything that we've talked about today? Or even some kind of general closing thoughts on your PDA use.

**Male:** I've noticed that more males are interested than women. I mean, for men, I don't know if it's generally the case, but I think-I don't want to be politically incorrect about it, but I think in my experience, men are just more interested in that. It's more enjoyable to them. It's more fun, I guess. For the women I've talked to, it's more, not a burden really, but it's not-They see it as a tool and they don't see it like a fun or plaything or something like as much. Whereas the men I talk to, think, well, that sounds cools, something I would enjoy using. Whereas for women, it's more like, I really don't want to get into that until I have to. When I feel like I really need it then I'll use it.

**Jon:** I know you guys probably have meetings for all the healthcare providers, whether not they're physician assistants or doctors. What percent would you say use the PDA?

**Male:** It's more than before, but I think it's still a minority. It would probably be-I can only think of like two people that use it outside of like the IT guy. But as far as clinical people, you know, I think our medical director, our former medical direction did. I don't know if our new medical director does or not. I'm not sure. And I know our associate director does. So, I think it's more people that some administrative responsibilities, too. I don't know-I'm not aware, but I would guess maybe out of the doctors we have, maybe one or two do and I'm not aware of it. I'm not sure of anybody who does, but I have an inkling that maybe one or two of them do, of the doctors. And I would guess probably none of the nurse practitioners that I'm aware of. Probably none of the nurses, I would think, use one.

**Jon:** I'm pretty much finished. The only thing, do you know of any MD's that you think would be willing to spend some time with me at all?
**Male:** It's hard, 'cause their schedule is worse than ours, generally, as far as time goes. But I know within the university, one of the doctors who used to work here who's now downtown. Some of the ones who have contacts downtown. Some of the other doctors do work downtown, too. Schedule it during an appointment slot.
[End of Recording.]

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Jon Blue
Interview Audio File: DS330015

**Jon:** So, what I'm actually doing is I'm doing a qualitative study. I'm actually looking at physician's use of PDA's or non-use of PDA's. So, the requirement is that you have one or do not have one. But I'd like to try to understand a little bit more about why. There have been a lot of quantitative studies on PDA use and technology acceptance. Very little from a qualitative standpoint to understand. There have been studies that have shown, even from a quantitative basis, that physicians' use of technology is different, different than other environments. And so a qualitative study to try to understand and better explain that. And that's the reason for the research. What I wanted to ask you is a little bit about what kind of forms of communication do you use with patients from a technology standpoint and non-technology standpoint.

**Female:** I prefer oral and written, but I have a lot of patients who e-mail me. And I will respond, but I always put in the e-mail that it's confidential.

**Jon:** Okay, great. So, automatically put that on an e-mail. And so that other way is oral. Even by telephone?

**Female:** Yes.

**Jon:** Or face to face.

**Female:** Yeah. Mmm-hmm.

**Jon:** So, from the e-mail standpoint, though, how much would you say you use it each week?

**Female:** From patients?

**Jon:** Yeah for patients. Or both. Patients and non-patients.

**Female:** Oh, non-patients I'd say I use for communication 85%. And for patient, 10%. And that's a generous guess.

**Jon:** And what about from a personal standpoint?

**Female:** Probably 20%.

**Jon:** "Personally," being here or at home? Do you do email at home as well?

**Female:** Yes.

**Jon:** Okay. And when you're doing it at home, you're doing both the personal and the work-related. So at home, you do almost like 80% or more of the business-related e-mails?

**Female:** I guess I might not have understood the question. For business, I do most of it by e-mail. Personal, I do very little by e-mail.

**Jon:** Okay. So, you use the technology ore in your business.

**Female:** Yes.

**Jon:** Okay, great. And do you have a cell phone?
**Female:** Yes.
**Jon:** Okay. I see you have a pager as well.
**Female:** Yes.
**Jon:** Okay. And what other types of technology do you use?
**Female:** To communicate?
**Jon:** Yeah.
**Female:** And I don't leave my cell phone on.
**Jon:** Okay. And when you thin of technology, how would you define technology?
**Female:** Semi-convenient.
**Jon:** Okay. So, that's kinda your description, semi-convenient. So, would you say if you were to give me the characteristics of what a piece of technology could do for you?
**Female:** I can make more efficient by avoiding to having to leave messages. Also, it helps to retrieve information. That's why I particularly like e-mail so I can save it and have a copy of things.
**Jon:** I'm going to try to build on that a little bit more because I want to get a little bit more of a description, if that's okay. So, one is efficiency, so it makes you personally more efficient.
**Female:** Mmm-hmm.
**Jon:** Let me give my example to concur or change or add to if you would. When I think of technology, I may think of some type of tool that allows me to do something differently or in a better way and actually improve something by myself or the person that it's for. So, when I say a cell phone because instead of running around getting to the next person, you can call then on the telephone. Or, for instance, this recorder. Instead of me taking all the notes, I have a piece of technology that I can actually make it more efficient and quick or cheaper or whatever. So, take that as my definition. Do you agree with those things?
**Female:** I do at work. I don't agree at home. That's why I don't have my cell phone.
**Jon:** So, you don't use a telephone at all at home.
**Female:** No. I have it only for answering pages if I'm in the car or something. I never leave my cell phone on. People call me on my land phone.
**Jon:** People call you on your land phone.
**Female:** Yeah. That's why I have an answering machine.
**Jon:** Okay. Well, that's a piece of technology for messages.
**Female:** Well, it allows me to keep my home life and work life separate.
**Jon:** Great. So, you don't even have a personal cell phone at all.
**Female:** I do have one, yes. My kids have the number and my parents have the number.
**Jon:** That's for emergencies or just if they need to contact mom.

**Female:** Yeah, exactly.
**Jon:** Well, that's helps me understand a little bit more. Now, how familiar are you with the use of a PDA in the healthcare field?
**Female:** I use one of those.
**Jon:** Okay.
**Female:** I have a Palm Pilot.
**Jon:** Okay. What are some of the things you think that you can do with a PDA in healthcare?
**Female:** Well, I know you can use it for medications. It basically replaces the Physician's Desk Reference. I have not used it for programs other people have such as clinical vignettes or accessing cardiovascular risk factors. Things like that you can do on those; I just don't do them.
**Jon:** Okay.
**Female:** I tend to just use the desktop that's in the patient room I'm in if I'm needing to find an answer to a clinical question while we're talking.
**Jon:** So, you keep one in your room.
**Female:** Every room in the clinic-not here, but over in the private practice-has a computer in the room.
**Jon:** Okay. Has a computer in the room. So, you look at it online.
**Female:** Yes. While talking to-
**Jon:** You don't use a hardcopy of the book.
**Female:** Right, no. I'll just look it up while I'm talking to them.
**Jon:** Okay. So, you use your PDA more fro a reference standpoint, then.
**Female:** Yes. That's exactly right. I have drug formularies in there and that's about it. And I can run drug interactions or something. But it's really all I use it for.
**Jon:** Okay. If you think about the tools that you use, tools being books, PC, or whatever, how much would say from percentage? If 100% was all the tools and things that you use, what would say the percentage of PDA use would be with that?
**Female:** The PDA? Not just the computer.
**Jon:** Not just the computer.
**Female:** The PDA, I'd say 10% is generous.
**Jon:** Ten percent is generous. Okay. And those other types of things that you use from a resource standpoint or as a tool to use, you say PDA and PC.
**Female:** Mmm-hmm.
**Jon:** What are some of the other things that you use?
**Female:** Journals and textbooks.
**Jon:** Okay. And do you use those more from to do journal articles more or just to look up information and see what's going on currently?
**Female:** Probably the journals are more just to keep up.
**Jon:** Do you do any magazines at all?

**Female:** Yes.
**Jon:** And so you would call those the journals.
**Female:** Yes, yes. I have some of what are kind of the standard internal medicine journals that I receive.
**Jon:** Got it. And so do you use the PDA at all at home?
**Female:** At home? No. My husband uses one. He sells them.
**Jon:** Okay. Would you say it's easy to use?
**Female:** Oh yeah.
**Jon:** Okay. So, it's not a problem at all.
**Female:** No.
**Jon:** So, what do you think the characteristics of the PDA that you enjoy the most?
**Female:** Compact.
**Jon:** Okay.
**Female:** The amount of information you can store in it is very useful.
**Jon:** So, compact.
**Female:** The thing I don't like about it is you have to update is and that's where I fall down on the job.
**Jon:** Okay. So, when you say "update," synching it? Okay.
**Female:** I wanted to use another term.
**Jon:** So, synching it with the PC and brining it up to date.
**Female:** Yeah, yeah.
**Jon:** Now, do you use it all for like addresses or phone numbers or anything like that?
**Female:** No. I did initially and it just didn't work.
**Jon:** It didn't work.
**Female:** Yeah.
**Jon:** Okay. So, what would be some of the changes to a PDA that would make it more useful for you?
**Female:** If I didn't have to synch it.
**Jon:** Okay.
**Female:** If there's someway I could just do it right at work without having to have another cable and all that stuff, then I would love it.
**Jon:** It's just not there yet. Okay. And anything else that you think that would make it more useful for you in regards to environmental size, shape, the way it looks, reading it, or anything like that?
**Female:** No, I think really. The cost, you know. It's expensive. I can get one; it's not a problem. Like with the house staff, the residents and stuff. I think it's inconvenient for them and the medical students.
**Jon:** Right, right. I understand that. So, it's not confusing. You said it's pretty easy to use.
**Female:** Mmm-hmm.
**Jon:** It's not very frustrating to you at all.
**Female:** No.

**Jon:** You think you can actually get to it pretty easy.
**Female:** Mmm-hmm.
**Jon:** It's not cumbersome, do you think?
**Female:** No.
**Jon:** Okay. Now, where do you usually keep your PDA?
**Female:** In my coat pocket.
**Jon:** In your coat. Okay. These are kind of ease-of-use questions. So, you're saying clear and understandable.
**Female:** Mmm-hmm.
**Jon:** You can get to it. You know how to maneuver pretty easily.
**Female:** The real reason I don't use it is just that having to put all that information in it. I'm not comfortable putting in the information. I'm comfortable retrieving it once it's in there.
**Jon:** Oh, okay.
**Female:** That sums it up.
**Jon:** Yeah, that does.
**Female:** My husband putting in the information in for me, then I can get it.
**Jon:** Okay. So, it's really the updating of the information.
**Female:** Yeah.
**Jon:** So, the synching, as you said.
**Female:** Yeah.
**Jon:** Just sort of getting it all in there.
**Female:** Yeah.
**Jon:** So, you have to update the PDA and all that.
**Female:** Right, right. I just don't care because I can get it right in the room I'm in, so it just doesn't seem worth the time and hassle.
**Jon:** What about phone numbers and things at home? How do you use that? Say if you're out on the road and you need a phone number, like a cousin or an aunt or whatever?
**Female:** Oh, I would use my address book. I have to admit now I use the Internet to look up phone numbers all the time, which amazes me. I never thought I'd be doing that.
**Jon:** Really.
**Female:** Yeah, yeah. I'm not a computer person.
**Jon:** Okay. So, there's some use of technology that-
**Female:** I have to admit, yeah. Except for personal numbers. Any sort of business number I'll look immediately on the Internet for.
**Jon:** Okay. Good. And so you would say it's actually made it so easy to use it that it makes it even easier than trying to look in the yellow pages and that type of thing.
**Female:** Exactly. Yes.
**Jon:** And what about personal numbers that may not be on the Internet?
**Female:** Then I would have to look them up. I never look up personal

numbers on the computer.
**Jon:** Okay, right. Just for business numbers. Okay, great.
**Female:** I wouldn't know how. I know how to Google names.
**Jon:** Okay. The easier stuff. So, it doesn't require an mental effort. It's easy to use but it's the cumbersome of the synching is what kinda summed it up to you. So, you will continue to use the PDA, I'm assuming.
**Female:** Mmm-hmm.
**Jon:** If it were easier to synch and things like that, do you think you would increase the use of it?
**Female:** Oh, I would, yes.
**Jon:** Definitely would.
**Female:** Yes.
**Jon:** Okay. Even if don't use it and you do use it. Now, within your office and organization, what percentage would you say of the people that you work with actually use a PDA?
**Female:** Now we're talking about the private practice, right?
**Jon:** Yes.
**Female:** Okay. Oh, I would say 85%.
**Jon:** Eight-five percent. And that's actually your nurses, your doctors-
**Female:** No, just the physicians.
**Jon:** Just the physicians. Okay, good. That's exactly what I want.
**Female:** Yeah. The nurses do not at all. Clinically do not.
**Jon:** Clinically do not.
**Female:** And they're nurse practitioners, not clinical.
**Jon:** You say you don't use it as much as some of the other doctors, your husband or others may use. Have you heard anything from a personal or professional standpoint from them why they use it or don't use it? Have you ever had any discussion on that or heard of any discussion on that?
**Female:** Oh, they just think it's much more convenient.
**Jon:** Okay.
**Female:** They love being able to just pull it out of their pocket and pull off the information.
**Jon:** Okay, great. And so if there were additional pieces, so for instance, you would basically be able to put a secure wireless device where you wouldn't have to synch your PDA that would increase the use of it.
**Female:** Oh, definitely.
**Jon:** Okay. So, the technology's out there, right?
**Female:** Yeah.
**Jon:** You have to get somebody to hook it up-
**Female:** Yeah. It's not going to happen.
**Jon:** So, you actually have support here for your PDA at all in your office?
**Female:** No.

**Jon:** There's no support. So, it's personal.
**Female:** Yeah. There's no support, that' I'm aware of, in our department.
**Jon:** Would you think that would help a little bit on the use if someone was able to set things up for you?
**Female:** Oh yeah.
**Jon:** So, what I'm hearing is that, "I just want somebody to help me get it together. I need support."
**Female:** Well, I need someone to get it together and then I need someone to help me when there was a problem.
**Jon:** And that would actually help you with-
**Female:** Yeah, but I don't think that's going to happen.
**Jon:** Okay.
**Female:** I know it's not going to happen.
**Jon:** If you were to discover that the PDA was very useful in your practice would you be more inclined to use it for more things?
**Female:** If that was the best way to do it then yes, I would use it more.
**Jon:** Even if it were difficult to use. Would you still use it.
**Female:** I'm pretty sure I would if I found that it help me with patients more. It doesn't matter if it were difficult. I would learn how to use it. I'm sure I would.
**Jon:** Okay. Actually, this is a very simple interview. I'm pretty much finished.
**Female:** Good. See, when you have a computer illiterate person-
**Jon:** Well, no. You actually gave me some really good data. I think it's excellent data. When you talk about, love it, love it, easy to use. But I just don't like working on it.
**Female:** Right.
**Jon:** No synch. And so you would say from a technology standpoint, the literacy and technology say a medium type of level?
**Female:** Oh, I'm the low medium, if that.
**Jon:** Low medium.
**Female:** I have increased significantly in the last first years, I have to admit.
**Jon:** Okay. And that is because you found it easier-
**Female:** I've just become much more comfortable with doing things on the Internet than I ever thought I'd be. But I think that's because the institution has made it much easier for me.
**Jon:** Okay.
**Female:** By having computers in the rooms. I don't know what you'd call up-to-date, what that would be called. Whether that's a search engine or what, but things like that have made it much easier for me.
**Jon:** Okay. And it's because it's easy to use and you because you can get the data that you need.
**Female:** Exactly.

**Jon:** And what about the currency of the information?
**Female:** Well, that's the other thing that's amazing to me. I actually have on my e-mail now, one of the journals I subscribe to sends me important articles on my e-mail. And I actually will review them that way more efficiently and more likely than looking at the paper articles.
**Jon:** So, you read it online?
**Female:** Yes.
**Jon:** You do read online.
**Female:** Yes.
**Jon:** Okay. Interesting.
**Female:** It just fell into my lap. It wasn't like I though, oh, I should do this. And I found that very helpful.
**Jon:** Okay. So, being exposed to different ways of using technology-
**Female:** Mmm-hmm.
**Jon:** -than you may have thought of probably may help.
**Female:** Yeah, yeah.
**Jon:** So that you could try things.
**Female:** Yes.
**Jon:** And if it's not, you go back.
**Female:** Right.
**Jon:** Because you did the addresses and names before, but you found them so difficult that you went back to your old way.
**Female:** If I don't have to enter information, I'll do it. But If I have to enter the information, forget it.
**Jon:** Right, right, right. Okay. Well, is there anything you want to add to it, change or modify to our session today?
**Female:** No.
**Jon:** The only question I have is that I actually am talking to several other physicians in student health. I am now conducting my interviews with physicians inside of VCU and VCU Health. Do you know of anybody that would possibly be willing to help me? I have a couple so far, like my doctor and so she's been working with me. And she's agreed to be able to talk to me as well. Do you anyone else that may want to-
**Female:** Do you want someone outside of Student Health?
**Jon:** It could be anywhere in VCU.
**Female:** Oh, sure. I'll give you some names.
**Jon:** Okay. That'll be great.
**Female:** Just contact them by e-mail.
**Jon:** I will do that.
**Female:** And you can feel free to say that I suggested you contact them.
**Jon:** Great. That would be very helpful.
**Female:** Let's see, who can I suggest? Okay.
**Jon:** This is going to be really helpful.
**Female:** Oh, I'm glad to help out.

**Jon:** I really appreciate it because it's qualitative, I don't need a lot. Let me turn this off.

**Female:** Sure.

[End of Recording.]

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Jon Blue
Interview Audio File: DS330016

**Jon:** First question I had to ask you was, what means do you use to communicate with your patients, other than the one-on-one contact?

**Male:** E-mail. And phone.

**Jon:** Okay. So, e-mail, phone. And, then, face-to-face.

**Male:** Right.

**Jon:** And so, when you think about your communication with the patient, what percentage of your communication is via each type? You know, how much would you say is a percentage e-mail, how much phone, how much face-to-fact?

**Male:** I would say 50% face-to-face. About 30% phone. And about 20% e-mail.

**Jon:** Okay. And so you use it professionally, I'm assuming, because you have 20%. What about personal use for e-mail? Personally as well?

**Male:** Yeah.

**Jon:** Okay. And so how much time in a week do you think you spend personally and professionally? I mean, first let's say personally? Saying hello to friends and doing whatever.

**Male:** Yeah. Maybe one hour a day. So, in a week maybe seven hours.

**Jon:** Okay. And what about professional?

**Male:** You mean like using e-mail?

**Jon:** Yes. To contact your patients, you know.

**Male:** That's probably two hours, one hour to two hours a day.

**Jon:** Okay. So, 7 to 14 hours, you would say. So, what about using just the Internet in general? Do you use the Internet personally?

**Male:** Yeah.

**Jon:** Okay. And how personally would you say, time, just on the Internet?

**Male:** I thought that was part of the first one.

**Jon:** Well, okay. This is e-mail. So, did you include e-mail in that as well?

**Male:** Yeah.

**Jon:** So, this is Internet and e-mail. So, it's not just answering an e-mail-

**Male:** Right, right, right.

**Jon:** Okay. And do you use a cell phone?

**Male:** Uh-huh.

**Jon:** Okay. And what other types of technology do you use other than a cell phone and the PC, which is kinda the Internet?

**Male:** I use my PDA.

**Jon:** Okay.

**Male:** Other types of technology. PDA. Text messaging.
**Jon:** And do you use both of those professionally and personally?
**Male:** Just personally the text part.
**Jon:** Okay. But the PDA professionally and do you use it personally, too, the PDA?
**Male:** Mmm-hmm.
**Jon:** Okay.
**Male:** Let's see if I can think. Other technologies. That's pretty much the major ones.
**Jon:** How would you define technology?
**Male:** How would I define technology. I don't know. I mean, it's broad and everybody has their own interpretation. Technology is, you know, just innovation that people are able to use to either get their job down-it fits in everyday life, I mean, using technology. But to define technology. I guess it's simply that. It's just that technology is, you know, the world's way of being able to accomplish things not only on the job, but personal life more efficiently.
**Jon:** Okay.
**Male:** You use technology to feed your kid as well as you're using technology to accomplish, write a paper. So, before you had books and now we have computers. With computers, you have even more access. New technology available at our fingertips.
**Jon:** Great definition. When you look at your efficiency, what becomes more efficient? I mean, doing a task becomes more efficient, but are the types of things that lead to that efficiency? For instance, one may be quickness, you can get it quicker or do it faster. That's an efficiency way of doing that. Other could be more data, different type of data. So, there's a lot of different things to why you think something is efficient versus not efficient.
**Male:** Having access to things at your fingertips. Say for instance if you were doing a paper, back a while ago, maybe 10 years ago, you would have to go look up all your magazines, go find those magazines or books or whatever. But now, your library might have all those journals downloaded on their web site. You can go look up a article out of a magazine that your library has a whole, you know, 20 years of journals on. And you just have that at your fingertips. It would normally take you maybe 15, 20, 30 minutes just to find one article in a magazine that, you know, you may not have in you library. But now it's all just categorized on the Internet in your library. You don't even have to leave home. You can access your library's website and get on it. Before you had to go into the library. That's definitely being more efficient.
**Jon:** Okay, great. And when you think about the PDA, what are some of the ways that a PDA can be used in the healthcare field? And not necessarily how you use it, but what's your knowledge of the way PDA's are used in

the healthcare field?
**Male:** Well, right now, people probably use them to replace their date books and their task list. It's something you can have at work, at home. You always have that available. Now, you can put PC-type information on 'em so you can write a paper, have it on your PDA, download it onto your computer. You can surf the Web on the PDA if you want to. Not all of those have that capability, though. I'm able to have that capability. There's no limit to what I can do with mine, as far as managing task lists. I can type up documents on mine. I can surf the Web. I can maintain my calendar. I mean, that's what I have on mine.
**Jon:** What about from a healthcare professional standpoint that can be used? Do you use it personally for healthcare things?
**Male:** Yeah. You can have a complete drug web site on there that you have access to. You can have books downloaded onto your PDA, OB/GYN books-my specialty-downloaded. You can have internal medicine downloaded. You have web sites downloaded that you can medications off of at your fingertip. And some people might even be able to put patient information on 'em, if it's private. Like someone who has their own office and they can have a link to their PDA. I mean, they can take that stuff home with 'em. But I choose not to do that, but you can do that. Probably even access your hospital's web site that you can see your charts, you can see patient's lab work. And if you access the hospital's website through a private, secure website. So, it's many things that can be done.
**Jon:** Obviously, you know quite a bit about them. Often times, I notice people that use it don't necessarily know about how you can use it in the health care field as well.
**Male:** Well, it can get quite expensive, too, and that's why you might choose not to use the World Wide Web on your PDA on your own. It's not free. It's something that you have to take in mind 'cause when the phone bill come back, it can be 3 or 400 dollars. But if you work that into your business, of course. But I work for the government and they don't pay for that.
**Jon:** Now, what type of PDA do you have?
**Male:** It's a Treo PDA.
**Jon:** Okay. And how long have you had it?
**Male:** A year and a half.
**Jon:** Did you have anything prior to that?
**Male:** Yeah. I had a Palm.
**Jon:** Okay.
**Male:** It's a Palm, you know.
**Jon:** It's Palm OS, right. It's an operating system, but it's made by Treo. So, you still use the still operating system.
**Male:** Pretty much, yeah. I have a Palm and I have a Treo.
**Jon:** Oh, okay. How long has it been since you started using a PDA?

**Male:** I can't remember. It's been about six years.
**Jon:** Okay. It's been a while. And so how much time do you think you use it, hours per week, say? Just an estimate.
**Male:** Probably four hours a day, maybe.
**Jon:** Okay. So, you use it as a really strong tool.
**Male:** Yeah, I use it a lot. Mmm-hmm.
**Jon:** Okay.
**Male:** That's probably a lot, though, because you're not really using it that much. Two to four hours, I would say.
**Jon:** Okay. And that's professionally and personally. How do you split that time?
**Male:** Probably half and half.
**Jon:** Okay. So, do you find it easy to use?
**Male:** Initially, it's probably not that easy to use, when you first get a PDA. But once you have read the manual, understand. If you have a basic understanding of PDA's, like you've had one before, it's probably not that difficult. But to the layperson who gets their first PDA, I'm sure it's probably, not difficult, but the person who has a PDA is probably going to be, of some reasonable intelligence. But it's probably going to take a couple of months for them, or a month for them to get to know the PDA well. I think it's fairly easy to use once you understand all the, everything that you have available on it and then able to use it, you know, the way that you want to use it in your everyday life, as far as work and home is concerned.
**Jon:** What are the characteristics of a PDA that you enjoy most?
**Male:** Probably #1 is the accessibility. You have a lot of information accessible. You don't have to carry a cell phone. You don't have to carry a address book. You don't have to carry a calendar, a daily calendar. With mine, I have a camera. They now come with cameras.
**Jon:** So, all those things in one place.
**Male:** Yeah. All those things in one place. The PDA's that you would actually see, I mean, as far as phone book. You don't have to carry books 'cause you could have as many books as you want. You can get another card, a 1 gig card, put it in your PDA. You can have 2 gigs or however many you want. You can have everything at your fingertips. You won't even have to open up a books, if you don't want to. Most PDA's probably don't get on the web. But you just have a lot of things at your fingertips that you have in everyday life.
**Jon:** Do you actually get on the web on yours?
**Male:** Yeah.
**Jon:** Okay. And so what changes would you make to make it even more useful to you?
**Male:** When you have that, like, jack-of-all-trades but master of none. If it was just a PDA, not a phone, not a camera phone, you know, all

that, I think the PDA's of today, it would be good if you could type better on it, maybe type memos and do things. But you can't really do that. They do have connections where you type with your PDA. 'Cause Palm has that.

**Jon:** A keyboard or whatever.

**Male:** Stick your PDA in there and be able to type, docking and some things like that. But that would be the only thing. It's really hard to get it on a touch screen. I mean, that would be the only thing. More of them, the vast majority of them, you can connect to the web. I mean, I think that's the way that it's going, that you'll be able to access things with your PDA and be on the web. That means that every PDA probably will be a phone. That's technology that, maybe you might not want to go that way, but I think that's the way that it's going. I don't think there's anything else I can do with my phone.

**Jon:** How do you get information in and out?

**Male:** What do you mean?

**Jon:** Well, if you want to download a book, information or whatever, how do you do that?

**Male:** You have to connect it to a computer. And then you have to do that, you can just go to the website.

**Jon:** Wireless, you're saying.

**Male:** Right. If you don't have a phone that can connect, a PDA that can connect to the web, then you have to connect your PDA to your PC to download the information onto your PDA. But I can just go to the web and download it.

**Jon:** What about your names and address, personally and professionally? How do you input that data? Do you actually do it on the PDA or do you use a computer to do it?

**Male:** Both. Fifty/fifty.

**Jon:** Okay. So, I would say you're at the top end of PDA use. But when you go back and you think about it, do you think it was confusing when you first started using it? Is it different than doing other types of things?

**Male:** It's different. You get like a paper person, like a person who wants to have a address book, they want to have a calendar they can write in. Some people like to write. They don't want to do a touch screen thing and put things in. They don't like technology. Some people just want to keep things basic. Drink Heineken. They want to be domestic. They don't want to drink, you know-

**Jon:** I high-end-

**Male:** Yeah.

**Jon:** Right, right.

**Male:** They just want to keep it basic. Sometimes I'm that way, but I think you just have to-In the information age and you know where things

are going and you have less time to do things. I think it just makes your life more efficient to be able to have these types of things at your fingertips.

**Jon:** So, when you first started using it, did you find it frustrating at all?

**Male:** Not frustrating. A little bit frustrating, I would say. You meet someone and you're like, "Yeah, let me put your number in my PDA." And then you gotta their number in, put their last name in, when you could just write it. It takes a little more time. But now what you can do, you get their last name, their first name, their e-mail address, work, home. When you have it in your phone, you ain't gotta go look on no paper; you just click on it. And where you gonna keep the paper at? You gonna keep a address book and a calendar in your pocket? I can flip out my PDA and I got it. I can e-mail 'em from this, too. I can call 'em. I just have a lot at my fingertips. It's just much better.

**Jon:** Now you actually have a PDA that does, 4, 5, 6, 7 different things. Do you feel it's cumbersome at times?

**Male:** Yeah, I mean, it's a cumbersome thing. You keep it on your hip. You're not going to carry it in your bag. So, it can be cumbersome, but I think that it's utility. I feel like I can't live without it, which I can. But you get that way. It's like, how can you live without a cell phone. And back in the day, you didn't even have one. You stopped and put a quarter in the, ten cents. Now, somebody tell me that didn't have a cell phone-They got three people in their family and one cell phone. I'm like, that's crazy. They don't have PDA's either. Sometimes it's just to keep up with and put things in. It's like, I can just write that down. It's much more easy. So, you gotta kinda still have the paper and pencil, say it's going to take a little bit more time, but once I put it in, it's going to be more efficient for me in the future, even though right now it might not be the fastest thing for me to accomplish when I have 10 other things to do, when I can just write it down in 30 seconds. It takes just a little more time to punch those buttons to put stuff in.

**Jon:** So, why do you actually do that versus write it down?

**Male:** It's fast initially but eventually it won't be faster. You have to go look in your calendar, go look in your phone book. Find the person's number. Then you gotta type it. I can just hit two buttons, find the person's name, touch the button and I'm on it. I got my whole calendar for a year on here, basically. You just that all at your fingertips. Birthdays, addresses, e-mails. I don't have to go upstairs to my computer to find someone's e-mail, 'cause I have it here.

**Jon:** How do you find the screen, being able to use it and see it?

**Male:** I think ergonomics are important. It's hard with the PDA phone to try to accomplish, make a PDA that's very technologically advanced. The

PDA part of my phone is not too advanced. If it get my Clie, it's way more advanced, as far as a PDA is concerned, than my phone. I have a basic PDA kinda system. On some PDA's, you can just write stuff and put it in. You can't do that on this phone. The screen is not sensitive to writing.

**Jon:** So, that is a characteristic that is not in your phone but it does do other things?

**Male:** Yeah, that would be nice. I don't know how they would do it, but. To actually be able to if I meet someone I can just write their name in. It's just like writing down a number. I can write, you know, "Jon Blue" and I can write your number and it's in my phone, versus punching these buttons.

**Jon:** Can you actually do that on other PDA's?

**Male:** Yeah, most of 'em.

**Jon:** So, you can actually just write it in and it's character recognition? Is that what it is?

**Male:** Right.

**Jon:** Okay.

**Male:** On the Clie and on the other Palm.

**Jon:** Doesn't have the other functions like this one does, right?

**Male:** Right. It's not a phone, it's not a camera phone. You can't e-mail from it. You can't download, like, wirelessly from it. You have to download it up with a PC to do that.

**Jon:** Okay. So, what's interesting is that you use your phone in the PDA and it has all these other functions as well. And so do you think it requires a lot of mental effort to use it?

**Male:** No, not a lot. I don't think-

**Jon:** Did it at the beginning?

**Male:** No, I don't think it's a lot of mental effort. It's a lot of mental anguish, you know what I mean. Not a lot of effort because it's just like everything I like, I mean, it's touch screen. Everything is labeled really good. If you want to go to task, you want to go to calendar. It's very easy to access.

**Jon:** So, do you use the PDA every time you have a task that you know your PDA can perform that task?

**Male:** Sometimes I can put it in my PC and before I leave work, I'll hot sink 'em to update.

**Jon:** So you use the PC 'cause it's right there and you can use the keyboard.

**Male:** Right. You sink and then you leave. And that's the same thing you do if you just had a regular PDA, too. The same type of uplink.

**Jon:** Okay. So, what you do is you keep it synced between the PC work. And what about here at home?

**Male:** Same.

**Jon:** You have dual sink techniques for home or at work. Okay. Do you always try to use the PDA in as many cases or occasions as possible?
**Male:** Most times. There are some things that I probably could use it even better for, but I'm still traditional in some things that I do. But too many things.
**Jon:** And you're going to continue to use it.
**Male:** Yes.
**Jon:** So, in regards to patient care, one of the things you use it, it seems like you tend to use it for some kind of a reference.
**Male:** Mmm-hmm.
**Jon:** From a patient care standpoint.
**Male:** Right.
**Jon:** But it's from a reference standpoint. Now, you talked a little bit about being able to have patient information and patient records and those types of things. Do you think that if you had the capability you would use it for that?
**Male:** Most likely, but it would be like if I was somewhere off-I would probably use a laptop or a PC more because if you're going to be typing notes. That's the only thing, if you were typing notes. To look up patient information, yeah, that would be pretty easy. But to actually type notes, it would be kinda cumbersome to type it like that.
**Jon:** Okay.
**Male:** If your PDA had the writing capabilities, maybe you could write the stuff in, but then again, you would have to have that, all the PDA's would have to have wireless capabilities. Why would you connect it to your computer, and write it on your PDA and connect to your computer when can just use your computer to type stuff in. We don't have that capability yet where you can have patient records, in patient/out patient where they're, you know, computerized. We used to use paper charts. We use paper charts.
?: Fifty, sixty, seventy percent of hospitals use-
**Jon:** Yeah. Well, MCV does.
**Male:** I'm sure. But we're behind.
**Jon:** But you know what? I say they do, but it's only about 18 percent of the hospitals using that these days.
**Male:** In Newport News, they use them. The new hospital uses it. Riverside. That's the name of it. Riverside uses it. You can write on your charts from home.
**Jon:** Oh, is that right? So, they have a secure-
**Male:** It's a secure network. It's electronic totally.
**Jon:** Is it required?
**Male:** Yeah. There's no paper.
**Jon:** So, it's a mandatory system.
**Male:** Yeah. It's not an option. We're moving to that, though.

**Jon:** You are moving to that.
**Male:** Mmm-hmm.
**Jon:** Do you work actually in a veteran's or a medical facility that's government run?
**Male:** It's government-run. We see veterans and we see active duty.
**Jon:** Okay. So, most all of them are going to that then pretty much, you think?
**Male:** Yeah. The whole military. Army, Navy, and Air Force.
**Jon:** Okay.
**Male:** Like I can be here in Portsmouth and I can see what someone writes about someone in San Diego. I can look at their labs, I can do all that. Somebody can be in Hawaii or in Japan using the same system. I can see the notes they wrote yesterday, patient's lab work. It's going to be connected like that.
**Jon:** Going to be all in one system.
**Male:** One system, that's correct. I think it's definitely warranted and needed. Hopefully it won't get hacked, that's the only thing.
**Jon:** Usually hacking comes from within. The majority of all hacking comes from employees. Only a few percentage come from outside. They are all sophisticated. You have a high level of security. But normally what happens is somebody that's authorized inside the government would be the ones that's hacking. And they can do that within the hospital now. They could go in and make changes. Especially if it's written, it's even probably worse, 'cause the person has access. You know, even with HIPAA, you know, you still give folks access. People don't realize how secure the technology is.
**Male:** You just have to learn the system.
**Jon:** When you think of other people that use PDA's, personally or professionally, other doctors, friends, whatever, what are some of the things you've seen them use it for? Do you have friends that use PDA's?
**Male:** Yeah, some of them. Same.
**Jon:** Same type of things?
**Male:** They use it the same way that I use it.
**Jon:** Okay.
**Male:** I mean, they may not use it exactly the same. I mean, but my PDA's different. I got people who have the same PDA that I have.
**Jon:** Oh, is that right? Okay.
**Male:** Yeah, at least one person.
**Jon:** And the requirement is not that they use it either, because of this study is looking at non-use, too.
**Male:** Right.
**Jon:** For people that don't use it, what would make them use it. It's probably even more interesting than people that use it because now you're already using it. I'm trying to understand why people don't use the

technology. What it does is it allows people that do use it the reasons why they do.
**Male:** Probably talk them into getting one.
**Jon:** Is that right? Maybe so.
**Male:** Yeah.
**Jon:** One or two more questions. If you found the PDA difficult to use but found that improved patient care, would you use it.
**Male:** What do you mean?
**Jon:** Well, I can usually figure something out. But even if a piece of technology was hard to use, if it helped you, would you use it?
**Male:** I'm sure I would use it if it increased the quality of care of my patients. But I don't find it that difficult.
**Jon:** Alright, is there anything that you want to add or change or modify based on what we've discussed today? PDA's, its use, non-use, how easy you think it is to use, anything that I didn't ask. I kinda asked questions that kinda led you places, but there may have been other things that you wanted to-
**Male:** I don't even know if I have anything. What can I add or how would I like to change it?
**Jon:** Yeah, yeah. Is there anything that we talked about today that you can elaborate more on or add to?
**Male:** You know, like in the Navy, everyone has a PDA, like officers. It's not mandatory, but it's like, you know, you need to have your PDA. People still probably use a PDA and they use some other type of management tools, you know, one that has a calendar/date book that they use. But everyone is given a PDA when they graduate from their, uh, whatever their unit is. And then if you don't, then every command gives every officer a PDA.
**Jon:** Is that right? Okay.
**Male:** And now the Navy and Coast Guard use the Treo Palm PDA. I think that not all society, but, I mean, if you're going to be in the information age, then everybody needs to be more savvy. Not a requirement for me, but it can make everything more efficient, you know, the PDA should be used by, you know, everyone.
**Jon:** Okay.
**Male:** I mean, there's nothing else that I could say I would like to change.
**Jon:** Okay. I'm going to go ahead and stop it.
[End of Recording.]

+++ ON-LINE DOCUMENT: DBlue-Interview 3-DS330001
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Jon Blue
Interview Audio File: DS330001
**Jon:** Okay, great. Let's go ahead and get started. What other means do you use to communicate with your patients, other than one-on-one contact?
**Male:** Obviously, I use the telephone. And I use some e-mail communication. I'm very nervous about opening that door, but I do have patients where, quite frankly, it just saves me time so I don't have lots of missed phone calls. So, I do use some e-mail. Primarily phone, either me making-Again, I don't know how much detail you want. Either I'm making the call or a nurse who works for me makes the call to the patient.
**Jon:** As much detail as you want to give and can give, 'cause the more data I have, the better.
**Male:** I do a lot of direct communications and I also have a nurse communicate by phone, and e-mail. Rarely by snail-mail. That would be extraordinarily rare.
**Jon:** Okay. And so your e-mail, that's from a professional standpoint. What about from a personal standpoint? Do you use e-mail?
**Male:** Do you mean a friend or someone?
**Jon:** Yeah, exactly.
**Male:** Definitely, yes. Absolutely.
**Jon:** Okay. And so how much time do you say that you would spend on e-mail say personally, and then also how much time do you spend professionally on e-mail per week?
**Male:** Per week.
**Jon:** And, you know, number of e-mails. You can talk about number of e-mails, you can talk about maybe the time, that type of thing.
**Male:** There's patient-related e-mail, and that's fairly modest. I would guess 45 to 60 minutes a week. Then there's personal e-mail, the one that's right in front of me to my old girlfriend, my wife. Oh, this is being recorded, I should have-
**Jon:** [Laughter.]
**Male:** No, that's okay. That's personal. And then there's professional where I interact with colleagues. So, I would say personal e-mail maybe 60 to 75 minutes. And probably maybe an hour 15 to an hour and 30 minutes professional between colleagues.
**Jon:** Great. Do you use a cell phone?
**Male:** Sparingly. I have a cell phone and it sits in the glove compartment of my car. I don't carry a cell phone with me.
**Jon:** You do not. Okay. So.
**Male:** I should say that rarely. In other words, if I'm at a restaurant and I'm on call, I will carry my cell phone. But 98% of the time, 99% of

the time I do not carry a cell phone.
**Jon:** Okay. Is the cell phone a personal cell phone or is it one that was given to you by VCU?
**Male:** This is my personal cell phone.
**Jon:** It is your personal cell phone. And so when you're on call, they page you and then you call them back using the cell phone?
**Male:** That's exactly correct. They don't contact me on my cell phone.
**Jon:** Okay, great. What other forms of technology do you use, if any?
**Male:** Other than my computer and a cell phone, I do not. I do not use, you know, recorded music, electronic music, iPod, MP3-none of that. I do not use a Blackberry. I do not use PDA. I'm one of those old farts.
**Jon:** That's okay. That's good. Actually, you're my prime target for the study, so.
**Male:** Okay.
**Jon:** So, that's a good thing. How would you define technology?
**Male:** Oh, man. I'm going to put it in the context of what we've been talking about. Electronic devices that make life more convenient, that save time, that facilitate communication.
**Jon:** Great.
**Male:** The technology that's in my hybrid car, but that's not what we're talking about today, so.
**Jon:** Well, I mean, it could be. It does something to you. It does something else though, right?
**Male:** I'm sorry.
**Jon:** You say the technology in your car, I mean, that could be part of your definition as well.
**Male:** It definitely is. I don't have a navigation system, but when I drive my wife's car, she does have a navigation system. I never use it, but I guess that might help me in some unusual situations.
**Jon:** Okay.
**Male:** I guess the other thing is that technology, as part of the definition, it's more than time. It might facilitate organization.
**Jon:** Okay, great. Do you have a familiarity with the PDA use in the healthcare field? Like you said, you don't use it, but what level of familiarity do you have with it?
**Male:** I know that colleagues use it for their appointments. In other words, they keep their personal calendar on that. I carry a Sierra Club calendar, you know, one of those little books, spiral books with pretty pictures. But I know they use it for appointments. They use it to pull up important phone numbers. Some use it to keep medication information. You're probably familiar with Epocrates.
**Jon:** Yes, definitely.
**Male:** That's what my colleagues use it for. I, obviously, since I don't own one, I don't use it for those things. And then, obviously, people

who have the Tripod or whatever it's called, but with Blackberry and other PDAs.
**Jon:** The Treo. Right.
**Male:** Treo. That's it. That gives you an idea of how technically orientated I am. I had the right prefix.
**Jon:** You did, you did.
**Male:** Yeah. So, I see how people use that as their phone, their Blackberry for mobile communication, my e-mail. I do see that.
**Jon:** Great. And so have you ever used a PDA before, actually try one out or anything like that?
**Male:** Other than somebody saying, "Look at my PDA and look what it can do." I've never used it for my own personal use.
**Jon:** Okay. So, let's get a little bit more in detail about the reasons of not using it. What, if anything, would make you want to use a PDA? What would it have to do?
**Male:** It would have to convince me that it saves me time. Time would be the big issue. When I thought about that, I have not convinced myself that it would really save me time on what I do.
**Jon:** Okay. So, time seems to be the most important factor for you.
**Male:** Right. Timesaving device. I mean, it obviously could go beyond that. It could be that it contains information. For example, like Epocrates that I would not have ready access to. But being in an academic institution, I have pretty ready access to that information without carrying my on Epocrates.
**Jon:** Right. Okay. So, if you had to do any lookups, do you usually use a PC or do you go on the Internet to do that, or do you actually use a hardcopy?
**Male:** I go on the Internet, which I'm modestly familiar with.
**Jon:** Okay, great. What about from a personal standpoint? What would have to happen from a personal standpoint? Would it be the same in regards to time or?
**Male:** You know, the expression. I feel the luddite. It's a very anti-technology kind of person. Anyway, I'm getting off subject.
**Jon:** [Laughter.] That's okay.
**Male:** I can't imagine. I guess, you know, I know people use them to remind of appointments, but I have a digital watch that I can set an alarm for. I don't know how I would use it in my personal life. I'd be more accessible, I guess. But I'm just as accessible as I want to be.
**Jon:** Okay, okay.
**Male:** And I think that actually is partly the concern. I don't want to be too accessible. When I have professional responsibilities of being on call, I'm totally accessible, but if I don't need that, I don't need to be so accessible. I don't think anything is quite as urgent as people-Well, now we're getting philosophy here, but. I think people feel

this need to be ultimately accessible. I don't feel that need. If I don't get the e-mail on my Blackberry, you know, now, I'll get it on my computer at home in five hours.
**Jon:** Got it. So, nothing is that urgent that you, I mean, you've been able to do without it for a while.
**Male:** Now, I have to tell you, my wife carries a cell phone, which she keeps on, so if one of my daughters, who lives in California, wants to get in touch with use and we weren't home, she could always call my wife. She carries a cell phone on, I carry it in my glove compartment for a page that I get while I'm driving so I can answer the page.
**Jon:** Got it. Okay. You've seen the PDA's and you're saying that the only aspect of using one was, let's say, if you had a friend that said, "Look at my PDA."
**Male:** Right.
**Jon:** Do you think that it would be confusing? Are there aspects of that in looking at that?
**Male:** I'll be honest. I think I'm a little intimidated.
**Jon:** Okay.
**Male:** And there is a learning curve. And I don't know if I want to take the time to get onto that learning, so I'm well aware that everybody says once you learn how to use it, it's like, you know, it's very, very simple. But I would say I'm a might bit intimidated by learning how to do it. I don't think of myself as stupid; I'm pretty smart. Despite that, we all have areas where we don't feel so smart.
**Jon:** Mmm-hmm. And so when you say kinda the learning curve, time to get on that learning curve and to learn it. You definitely could learn it, so it becomes frustrating or confusing or cumbersome to use. Therefore, instead of going through that, you're saying why bother.
**Male:** Yeah. Now, I have to tell you, intellectually-You ready?
**Jon:** Yes, go ahead.
**Male:** I think what I just said is pretty dumb. Let's face it. I could learn how to use it and after I learned how to use it I would say, "Gee, how I have never not used it."
**Jon:** [Laughter.]
**Male:** But I just don't feel it would impact my day-to-day life in terms of saving time and organizing what I do, that it wouldn't improve those areas sufficiently to justify whatever time it took to learn it. Does that make sense?
**Jon:** That makes a lot of sense.
**Male:** I may be wrong, but that's the way I think about it.
**Jon:** Right. It makes a lot of sense to me. What you do is you weigh the benefits from it in regards to what you get from it, in regards to the effort and time to get there, is what I'm hearing you say.
**Male:** I think some of it is also I'm ornery. I mean, I walked to the

parking deck with one of the surgeons the other day who had his Treo. And while we were walking, it went off. And then the next thing he did is he checked his e-mail messages and he said, "You know, I don't know how I got along without this thing. It makes my life so much easier." And I'm saying, what is wrong with me. And I've thought about it. I genuinely don't think it would make that much of a difference. I could be totally wrong, of course.

**Jon:** Right. Let's say that you got to appoint in your life, and this is more hypothetical, and you say that, you know what, I just found out that this PDA is going to save me a lot of time and the benefit is going to be worth the effort of getting to use it. Now, do you believe you would find it easy to get the PDA to do what you want it to do?

**Male:** I don't think it would be easy. I think that I could do it, but I wouldn't use the word "easy."

**Jon:** Okay.

**Male:** I think that I think it would be difficult, but doable.

**Jon:** Difficult. When you say difficult, would you mean being the mental effort involved in it?

**Male:** Well, to learn the details of which buttons to push and what to do to make it do the things I want. Again, but intellectually, I see people get out and they do, b-b-b-b, and what they want comes right up. And again, it's just a sense that the advantage of using it is outweighed by that learning curve that I might have. And the fact that I truly don't think it would make my life a lot easier.

**Jon:** Right.

**Male:** You're not going to use my name, are you?

**Jon:** No, not at all.

**Male:** And I've gone through this with people when we've been around lunch and discussed this thing. People say I'm hopeless.

**Jon:** Actually, this is really good. It seems like the whole premise is on ease of use of the equipment, and the benefits versus the effort.

**Male:** Exactly. Ease of use, which intellectually I know I could do. I mean, I put together PowerPoint presentations and I do a lot at home on my computer in terms of investment information. So, I know I could do it; I just don't care to do it because I'm not convinced it would make my life easier.

**Jon:** I understand exactly what you're saying. It's very clear. When you think about a PDA and patient care, do you think that it would be something that-I'm not saying that there aren't other ways.

**Male:** Sure. No, no-I'm open-minded.

**Jon:** Right. Not saying that there aren't other ways, but do you think it would be a very good use of a PDA in the patient-care environment?

**Male:** I think it might facilitate not so much the care of the patient as the business side of it, in terms of storing. Yeah. I think there might

be some aspects. There are two places that I see patients. I see patients in my office. I don't think it would particularly facilitate billing there. But when you're walking around the hospital seeing consultations or in-patients, it might facilitate the billing process. In fact, my department is thinking of getting us to use those for that purpose.

**Jon:** Oh, okay.

**Male:** Now, that's financial, that's not quality of care. I guess what you're getting at, do I think it would improve the quality of care I provide.

**Jon:** Right.

**Male:** I don't think so. I'm hesitating. I'm trying to think how it might do that. For example, I might be able to pull up some drug interaction. But I have ready access to that because I'm in an academic medical center. I wonder if I might be more interested in this if I were in private practice. But I have ready access to lots of resources at MCV, where if I were in my little private office, I would have access. So, I don't feel the need as much. But I don't know how. I know some people have all their patients on there and all their medications. I just walk down the hall to chart room and pull their charts.

**Jon:** So, that's what you would do.

**Male:** If I needed to know patient Jane Doe's medication, I pull the chart. Now, that's some inefficiency. I might not be in that area. For example, I guess it's possible a patient wants a prescription refilled and I don't remember what they're on. I have to go to the next building later that day and I'd pull the chart and I look, whereas I might be able to pull it up. I don't know if a PDA could-

**Jon:** Oh, absolutely.

**Male:** -handle 2,000 patients with their medications. I guess it could.

**Jon:** Yeah, oh yeah.

**Male:** So, I think there are some ways that it might be more efficient. But in terms of the quality of the care, I don't see it. I'm sure somebody could convince me if they showed it somehow, but I don't see it affecting quality. I think it might provide some efficiencies for me in terms of my time.

**Jon:** Okay. Got it. When you think about others that actually use a PDA, were they personal and professional?

**Male:** I see it more in the professional side, but I know-I have a friend who loves wines and he is hooked up to some wine thing. And he can pull up all the California cabernets and what the wine spectator rating for them is on his PDA. It's pretty cool. But, you know what I say? I won't say it, but who gives a-

**Jon:** Right.

**Male:** That's great. And it's kinda neat and I say that's neat. You

know, part of this is-You can tell from my date of birth that I'm 60. I just turned 60. And I think part of it is the generational thing. Although the guy I'm talking about is actually older than me.
**Jon:** So, you say a generational thing, meaning that the way that you originally learned?
**Male:** I mean, obviously, my kids grew up using computers and using electronic-Actually, they use much in the way of electronic devices, but their generation certainly did. And I don't think it's as intimidating to them as it is to me. I mean, I'm beginning to sound like an old fart here, but. I use computers when you called. I'm sitting here in front of my computer at home going through a PowerPoint presentation I have to give next week, so. But I use computers for very specific purposes-word processing, PowerPoint presentations, and e-mail. Those three things probably account for 98% of what I use it for.
**Jon:** Got it. Great. Actually, it sounds like I've gotten a good understanding of your non-use of the PDA, what are the things that would actually make it more useful for you. In thinking back over what we talked about, is there anything that you'd like to change or modify that we've talked about?
**Male:** I don't think so. I would boil it down to, I'm not dumb. I understand intellectually how it might be useful. But when I add up the plusses and minuses, my net is that the impact on my efficiency and time would be so trivial that it wouldn't be worth the effort.
**Jon:** Got it.
**Male:** There are people who are just rolling their eyes.
**Jon:** Yes, but everyone's different. That's what makes the world go round.
**Male:** Exactly.
**Jon:** Different people. If you found that there was something in a PDA that would improve the quality of patient care would you use it then? And there wasn't another way.
**Male:** I guess so.
**Jon:** Would it matter how easy it is to use?
**Male:** No, I suppose not if it truly improved patient care and there wasn't another way that I would prefer.
**Jon:** Any other thoughts or comments that you have?
**Male:** No. I think just from hearing your responses, I think you kind of understand my thoughts.
**Jon:** I do.
**Male:** So, I think I've been able to convey that fairly clearly.
**Jon:** Well, that actually was painless, right?
**Male:** Yeah, it was interesting.
**Jon:** I really appreciate that.
**Male:** Well, what it does is it makes me think about something that I don't do and maybe tomorrow I'll buy a PDA.

**Jon:** [Laughter.] Just to try it out, right?
**Male:** No, no, no. It ain't gonna happen.
**Jon:** [Laughter.]
**Male:** I mean, I have a laptop. I brought my laptop to work. See, I take the laptop because I work on presentations. I'm a teacher and I do a lot of presentations and I need it for that. But I don't know how the PDA part of it would help, so.
**Jon:** Thank you very much.
**Male:** You're very welcome.
[End of Recording.]

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Jon Blue
Interview Audio File: DS330003
**Jon:** I see that you do use a palm. So, what other forms of communications do you actually use to communicate with your patients outside of the one-on-one, day-to-day?
**Female:** Obviously, telephone. You mean things like that?
**Jon:** Yeah.
**Female:** Yeah. And some e-mail. Evidently, our e-mail is not, not considered confidential for patient records, so I try not to do it. The other aspect is you don't get paid for any of that additional work, so. You know, it's a consideration 'cause technically, you could spend hours doing e-mail back and forth with patients. I don't necessarily want to open that window. What a lot of people are doing now, and probably you've heard of these, more like with managed practices. You pay $4,000 up front for a year of coverage under this physician and as a result, you get round the clock phone access, web access, and all that stuff. In those types of practices, I think physicians really are communicating a lot. But we do not have that at all. And physicians in that practice would have fewer patients. We have the regular full panel of patients, which you could spend the whole day e-mailing 600 patients. So, it's a matter of how you manage your time and how you get paid for your time.
**Jon:** When you do use e-mail, I'm assuming it's a high level, it's back and forth-
**Female:** Right, right. Actually a lot of employees in the hospital. So, I just don't spend a lot of time with it. I know it varies. Some people do more than others, so. It's definitely still in flux now for the health system here on having more people to do it.
**Jon:** Oh, is that right? So there's really not a-
**Female:** There's no policy.
**Jon:** No policy or anything.
**Female:** Right.
**Jon:** It's just sort of whatever you feel more comfortable with.
**Female:** Right. It's probably coming down the line maybe in a year or so, people are going to issue some policy about it.
**Jon:** And so, when you think about e-mail, at least from a professional standpoint, or dealing with patients, who many hours a week would you say that you would spend on e-mail?
**Female:** Oh, currently, now, with patients?
**Jon:** Yes.
**Female:** Very little. Not even an hour.

**Jon:** An hour within a week.
**Female:** Yeah, yeah.
**Jon:** You wouldn't even do that. Okay. So, it's mostly in the one-on-one. Now, what about by telephone?
**Female:** Well, I have a nurse and they do a lot of that. I call people if I get an abnormal result or like I need to tell 'em they have diabetes or cancer or something serious. Otherwise, we send letters. I get their labs and I write a little letter with the results. That's another form of communication, mail.
**Jon:** Okay. I'm assuming, then, that the majority of time is one-on-one and everything else is what else?
**Female:** Oh, 98% is one-on-one.
**Jon:** Got it. That's makes sense. Now, do you actually use e-mail professionally?
**Female:** Oh, yes.
**Jon:** I mean, personally.
**Female:** Personally, oh yeah.
**Jon:** Okay.
**Female:** Too much.
**Jon:** Do you use it a lot?
**Female:** I'd like to turn it off.
**Jon:** You use it at home and at work?
**Female:** Yeah. Well, I do a lot of work at home, too, so.
**Jon:** Okay. Now, the work at home, though, I would consider that professional use.
**Female:** Right.
**Jon:** But do you use it to do friends or relatives to stay in contact?
**Female:** A little bit, yeah.
**Jon:** If you were to say how much e-mail you do at home or personally.
**Female:** At least an hour a day, probably. Yeah, at home.
**Jon:** Okay. So, about 7 hours a week you would say.
**Female:** Yeah, definitely, or more, yeah.
**Jon:** I see you do have a cell phone.
**Female:** Right, right. All wired up here.
**Jon:** And do you use that pretty regularly or would you say it's a scant use just for emergencies?
**Female:** Which one, the cell phone?
**Jon:** Cell phone, yes.
**Female:** I have it on right now, but normally I keep it off 'cause the batter runs down. But I'm using it more and more. My husband got me one just a year ago and I use it more now. It's very convenient. I have a pager as well. You know, before if you got paged, you'd have to go try to find a phone and now it's great to just have a phone. So, normally I have that off, my phone off and I turn it on if I get a page and call

somebody back.
**Jon:** So, most people have your pager number?
**Female:** Yeah, yeah. Not friends, but my husband and obviously the office.
**Jon:** It seems like the forms of technology you use, you do have a cell phone. You have a pager. You use the PC at home. Any other forms of technology that you use?
**Female:** Like what? Can you think of anything else? I don't know.
**Jon:** I think you most of them. How would you define technology?
**Female:** Ah, define technology. Gosh, that's hard. All of technology? I guess it's an extension of human tools. Just like we had the plow and then horses and cars. And now we're using computers. Technology can be used for anything. For medical devices or for communication. So, it's all like a way for human beings to extend their influence.
**Jon:** Okay. I see that you do have a PDA. What are some of the applications that you know about that are able to be used in a healthcare field on the PDA?
**Female:** On a PDA?
**Jon:** That you know of. Whether or not you use them or not.
**Female:** Okay. Well, I'll just tell you the ones I know, first. I use the Epocrates. I have all the little bells and whistles like a lot of the calculation tools. And I use them a lot. They're nice. And they have a service where they would also e-mail you updates. And clinical research. But I don't use that because I get so much e-mail I don't want any more e-mail. But I actually am reconsidering whether I should use one. That is pretty helpful. You know, just up-to-date with what was published in the Lancet last week kind of thing.
**Jon:** Okay. Just kind of download it to your PDA and use it when you want it.
**Female:** Right. The other thing-I don't do this, but a lot of people use it. They do their entire patient charting on the PDA and they download that right into their, whatever the hospital computer order entry system is. So, anything you can do in a hospital setting on a computer, you would use on your PDA or Palm and you can have right there at the bedside. Obviously, you could also do e-mail with your patients, if you were doing that. And then just all kinds of medical database. I have like a medical textbook on here, so I use that.
**Jon:** Is that just more from a reference standpoint or?
**Female:** Yeah. It's called the Five Minute Clinical Consult. But it helps. Rather than having to even go to the web and look something up, I can look it up in the room with a patient.
**Jon:** You carry it with your patient. You don't just keep it away. You actually carry it into the-
**Female:** Yeah.
**Jon:** Okay.

**Female:** There are a lot of other things, too. I'm not totally up-to-date with all of 'em. A lot of the things that came out that used to be all separate, a lot of those sort of tools, especially calculation tools, they're all sort of synthesized now into one.
**Jon:** Right. What other things do you actually use your PDA for?
**Female:** Calendar, address book, all that basic stuff that's on there. I use the time thing. I have some relatives in other countries. A little map. I use the date book a lot. And then I have this reference guide on there. I teach a course that's all distance education, Blackboard.
**Jon:** Okay, right. Sure.
**Female:** And we, uh, send the students out with Palm Pilots to collect patient data. And then through AvantGo, they download all their data and well look at that every month. We do that with our clerkship. So, every four weeks we look at that data, which is kinda neat. And that's what this woman I was telling you about, she's doing her Ph.D. on that.
**Jon:** That's great. Think of your use of the PDA, personally and professional. How much time do you think you use that?
**Female:** That's hard. Hours. Maybe an hour a day total. It's hard to say, you know, 'cause you get on, you just look something up. It's not like you sit there and read it. So, that would be at the most. Maybe a half an hour. Hard to say. But not more than that.
**Jon:** And how long have you been using a PDA?
**Female:** Um, quite a while. At least five years.
**Jon:** Okay. So, you're one of the early adopters, then.
**Female:** Yeah. At least since 2000, year. 'Cause we had 'em for the clerkship. That's how I started.
**Jon:** Okay. And now what type do you use?
**Female:** Again, this is what we used to give the students. This is a Sony Clié. The students now have something even fancier than this. And then I had one before this, too, and I can't remember the name of it.
**Jon:** And so you kind of find it easy to use?
**Female:** Yeah, yeah.
**Jon:** Okay. And so what are the characteristics of your PDA that you enjoy most?
**Female:** Oh, the, like-
**Jon:** Environmental characteristics?
**Female:** Especially Epocrates. All that. Before when you had to look up drugs in a PDA, you know, the books were this big. And I'm terrible with the alphabet 'cause I have like dyslexia trying to figure out if Z comes before Q. It takes me forever.
**Jon:** [Laughter.] Okay. So the quick, easy-
**Female:** Yeah, quick, ease. Yeah. And the fact that they update it all the time.
**Jon:** Okay, great.

**Female:** And then the calendar. I used to have three different jobs.
**Jon:** I was asking you about the characteristics of the PDA. Get the information quickly, being able to get the information and keeping it up-to-date, a couple things you talked about.
**Female:** Small.
**Jon:** Small. Okay.
**Female:** Fit in your pocket. Not too heavy.
**Jon:** Okay, great. And so what are some of the changes you would make to the PDA to make it even more useful? Can you think of anything?
**Female:** Even lighter. Actually, even just the weight it is, with my stethoscope in my pocket it give me like sort of a neck strain if you carry it around all day.
**Jon:** Right.
**Female:** Just lighter. I'm not that kind of a thinker. Like I said, after this, I'm probably going to go to one of those combination phone palms. So, you're carrying around one less thing and I don't have all these things in my pocket. Well, normally I'd never carry my Palm Pilot around me like to go to the playground, but, you know. One nice thing is it'll have the address book and my phone book and not have to duplicate everything.
**Jon:** Okay. And you said it was kind of easy to use. Do you find it confusing or frustration or cumbersome at all?
**Female:** No. I mean, there's a lot of things on there I don't know how to use. But I always ask people, like the file swapping and stuff.
**Jon:** So, you usually would ask for assistance if you need.
**Female:** Yeah, yeah. We have people in our office who can help. I can't remember. I had a problem with this when I was first trying to download Epocrates and somebody from the computer information system office came up and helped out with that.
**Jon:** So, you actually have some support that can help you within the office.
**Female:** Yeah.
**Jon:** Okay.
**Female:** Yeah, if you have any problems.
**Jon:** Right. And normally you usually don't have any problems with it, just kinda some of the small things? Seems like you retrieve information from it and use it as a reference tool. Do you use it personally from a standpoint with your names, addresses?
**Female:** Calendar.
**Jon:** Calendar.
**Female:** Oh, yeah. I was saying I had three different jobs. I remember like in '99, I was still writing a calendar on my desk and I would be somewhere else and I wouldn't have that calendar. I used to have meetings in all different places. My schedule is much simpler now, but

at that time, that was a big help to have everything-
**Jon:** In one place.
**Female:** Right. And small.
**Jon:** What about ergonomically in regards to visual?
**Female:** Yeah. This particular one is not that great. It definitely is kinda hard to see sometimes. It's not that bright.
**Jon:** Does it have a light on it?
**Female:** You're right. I probably-See, if I would of-What would I do, go to "preferences," there? Let's see. Increase the light.
**Jon:** It may or may not. But yeah, it'll usually have a contrast on there. But some of 'em don't even have a light.
**Female:** Now see, that's the kind of stuff I wouldn't do a lot of. I don't see any way to like make it brighter. Anyway, go ahead.
**Jon:** Okay. Let's see. Do you find it easy to get your PDA to do what you want it to do?
**Female:** Yeah, for the limited things I do on it.
**Jon:** Okay. And does it require a lot of mental effort?
**Female:** No, no.
**Jon:** Okay. Do you always try to use your PDA to do a task whenever it has a feature to help you perform it?
**Female:** Well, let's see here. I'll tell you what features on here I don't use.
**Jon:** Okay.
**Female:** Movie. I don't know what that is. I don't use that. I'm not doing e-mail on the palm.
**Jon:** You actually have that capability on this palm.
**Female:** I don't know. It says "mail." I don't know how to set that up. I do use the clock. I like that a lot. I tend not to use the "to do list." I mean, I have some things on there but I don't use it everyday. It just takes too much time to type it in and erase.
**Jon:** So, you actually do that more by hand somewhere?
**Female:** Yeah. I definitely use the "memo" a lot. Like I have a lot of stuff stored on there. Stuff I don't want to put in my address book, it's all in here. Like the phone number of the painter and stuff.
**Jon:** Tell me a little bit about the use in patient care? Do you think it would be very good to use a PDA for patient care? How do you currently use it? Are you actually in the room with the patient-
**Female:** Yep.
**Jon:** Look up the drug interaction? You don't go out. You actually-
**Female:** Yeah, looking up drug doses and use. And I always like to just-There are so many medications and I know before you might use the same medication over and over again, so you know the dosages, but there are so many now you can't memorize them. And I look that right up with

the patient there. And I'll talk about, "Okay, we'll start you off on this real low dose and the maximum would be 240 and we'll just see if you need that much." That kind of discussion. So, I'll have all that information right there. You know, if they ask about side effects, I can just say, "Okay, these are the side effects."

**Jon:** Okay. So, it's a lot more convenient for the patient as well.

**Female:** Yeah, yeah.

**Jon:** You don't have to go out and come back. You don't have to leave.

**Female:** Or if they ask a pharmacist.

**Jon:** Some let's talk about the PDA's possible usefulness to you in your position as a physician. If you find that the PDA was very useful to you in your practice would ease of use come into play?

**Female:** Well, I would like any technology to be easy to use. However, if I found that it would increase patient care that would be more of a reason to use it. Even it were difficult to use.

**Jon:** From a personal and professional standpoint, others that use the PDA, do they pretty much the same way as you use it?

**Female:** There are six doctors. And I know two of the other ones use 'em probably like to the extent I do. And the other ones, I think, less.

**Jon:** Okay.

**Female:** One, I know not at all. Like I said, I think I really got started on it by being in the clerkship of this woman who very much wanted to use these for teaching purposes for the students. So, that was really helpful to get started on it real early.

**Jon:** Did you actually start with a Palm Pilot or something else?

**Female:** Mmm-hmm.

**Jon:** Okay. And then kinda moved on a little bit. Okay. Is there anything else you want to add? Anything you want to change or modify in your responses?

**Female:** What's sort of your theory? What are you arguing?

[End of Recording.]

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Jon Blue
Interview Audio File: DS330004
**Jon:** First of all, what I'm actually doing is part of my Ph.D., my dissertation is really looking at the use and non-use of PDA's and trying to understand a little bit more about why physicians use or don't use PDA's.
**Female:** Okay.
**Jon:** From a technology acceptance model standpoint. A lot of different industries actually accurately predict the use of technology. But in healthcare, it doesn't work out a lot. So, what I'm trying to do is trying to take a more qualitative view to try to understand a little bit more. So, this shouldn't take very long. We're going to talk a little about your communication with your patients, how you do that, what are some of the technologies that you actually use currently right now. So, other than the one-on-one, what other ways do you actually communicate?
**Female:** Telephone.
**Jon:** Okay.
**Female:** I have some that do e-mail, but we're not supposed to respond.
**Jon:** Oh, is that right. Okay.
**Female:** Because of HIPAA.
**Jon:** Right. Okay.
**Female:** So, although I will accept their e-mail for me to me with information, then we either call them or wait till the next appointment.
**Jon:** Okay. So, if it's by e-mail, it's sort of like you kinda just say-You don't usually answer them.
**Female:** Well, I may acknowledge that I got it.
**Jon:** Okay.
**Female:** But I won't give them advice or, you know, plan anything on the e-mail.
**Jon:** Okay. So, anytime there's any lab results or whatever, they need to come in and talk to you pretty much.
**Female:** Or you can mail it to 'em.
**Jon:** So, mail is another communication.
**Female:** Sure.
**Jon:** So, if you were to say, percentage-wise, is one-on-one say 90+ percent? Or what would you say for one-on-one versus mail and also the telephone?
**Female:** Probably about 80 to 90%
**Jon:** Okay, great. Now, what about e-mail personally? Do you use it personally for your own-
**Female:** Oh yes.

**Jon:** Okay.
**Female:** Or colleagues.
**Jon:** Right. So, from a patient professional standpoint, it's very, very small. But on the personal view, how many hours do you think per week do you use it personally? Hours per week, hours per day?
**Female:** It's about 10:30. I've spent the last hour and a half on e-mails.
**Jon:** Okay. And so that's about how much you spend per day, you would think?
**Female:** Probably an hour and a half.
**Jon:** Okay.
**Female:** Some days a little bit more.
**Jon:** So, that would actually be personal and professional that you do here? Do you do it at home at all? Do you use e-mail at all in your home environment?
**Female:** Some. But I get most of it here.
**Jon:** Now, do you use like a laptop or anything like that?
**Female:** Yes
**Jon:** Okay. You said one of the laptops you kinda take to and from work?
**Female:** Yes.
**Jon:** Okay. And so that laptop, you use if for personal and professional types of things? Do you ever do a quick letter or-
**Female:** Well, we have two other computers at home, so we do our other stuff on that.
**Jon:** Okay, great.
**Female:** And then we have a little byte chip I bring back and forth.
**Jon:** Oh, okay. Great. Now, do you use a cell phone at all?
**Female:** Yes.
**Jon:** Okay.
**Female:** But I don't take incoming calls.
**Jon:** You do not take incoming calls. So, it's for emergencies going out. Okay, that's good.
**Female:** If I'm expecting a call, then I'll leave it on.
**Jon:** Okay.
**Female:** But otherwise, it's off or idle?
**Jon:** And that's usually then more for if you get paged? Do you use a pager? Okay. And the pager, is that mostly used for your professional?
**Female:** Absolutely.
**Jon:** Oh, okay. Any other technologies that you can think of, personally or professionally?
**Female:** Well, I use automated blood pressure monitors and things like that.
**Jon:** And that's pretty much professional but anything additionally on a personal basis. Okay. So, if you were to kind of sit back and look at

and understand what the word, "technology" means, how would you define it?
**Female:** I guess electronic things that are supposed to help us work easier.
**Jon:** And so when you say "easier," what are types of things when you think of easier?
**Female:** Faster. Sometimes cheaper. You know, like e-mail versus letters.
**Jon:** So, a little bit easier, a little bit faster. Cheaper, oftentimes. So, technology gives you that aspect. Now, when you think about a PDA or personal digital assistant, are you aware of its use in healthcare?
**Female:** Yes.
**Jon:** Okay. Do you know about some of the areas that it's used in healthcare?
**Female:** Some people use it to get their e-mails. Some people use it for their scheduling, use it for databases, things like up-to-date or PDR's, reference material.
**Jon:** So, based on what you said, you don't actually use a PDA.
**Female:** I do not. I have had a PDA. I got one that you had to replace the batteries rather than charge the batteries, and so it was always running out.
**Jon:** So, one of the reasons why you stopped using it. What are-
**Female:** I don't usually wear white coats, so I don't have pockets.
**Jon:** Okay. And so it's cumbersome, though, having it around.
**Female:** Yeah. I mean, you know, it's different for guy who has belts and you can hook it on your belt. But I don't. Plus we have enough computers in the hospital so that if you need to go and look up a quick reference, then you can go to a computer within the hospital system rather than having it in your pocket.
**Jon:** Do they have them in the patient rooms at all?
**Female:** No, we do not have them in patient rooms, but they're out in the nurses' stations, our office, clinics. Each clinic office now has their own computer.
**Jon:** Okay. So, that's recent?
**Female:** Yes. That's been within the past year.
**Jon:** Okay. And so before, you didn't have as much of an access to the PC, say you were working with a patient and looking for a drug interaction or something like, what-
**Female:** Right
**Jon:** You would go to the nurses' room. Okay. And do you keep that in your office or do they actually have one in the-
**Female:** They were around. They were supposed to be in each office, but they often walked away.
**Jon:** Okay. So, has that been more convenient for you, do you think, those PC's?
**Female:** Yes.

**Jon:** Is it easy to kind of get in there and do what you need to do, get to where you want to go?
**Female:** Yes. If we could just convert our notes to it. We don't do our notes in it right now.
**Jon:** You do not.
**Female:** No.
**Jon:** So, there's no type, right now, of electronic-based notes, records-
**Female:** Not here at this hospital. Our chronic dialysis unit, we do have a system where we do write our notes in the computer right next to the patient.
**Jon:** Now, you said you personally used to use a PDA. So, what did you actually use it for when you did have it?
**Female:** More for reference than anything else.
**Jon:** And reference being like drug interactions, information on referencing-
**Female:** Right. Side effects of drugs. I did not use it for e-mail.
**Jon:** You did not? Okay. Did you actually use it for your personal phone numbers or addresses or anything like that?
**Female:** Not much.
**Jon:** Okay. So, what do you normally do to get your addresses and things like that? Do you keep it online or-
**Female:** Ones I call a lot, I just memorize. I've got 'em on there the PC
**Jon:** And so how long would you say you would use the PDA when did you use it?
**Female:** Maybe six months.
**Jon:** Okay. Was it like a Palm VII, the one with the batteries, one of the old Palm-
**Female:** It had a battery.
**Jon:** Okay. And it would go out really quickly.
**Female:** Yes.
**Jon:** Did you sink it at all with your PC?
**Female:** Yes. This is a new computer, but the old one had the sinker.
**Jon:** It had the sink on there. Okay. In the course of sinking, or either way, did you actually put any information out of your PC that was downloaded into the PDA?
**Female:** Not much.
**Jon:** Not much. Okay. So, it was really more you would just make it as a backup?
**Female:** Right. And then that's how you would get the new info.
**Jon:** And how often?
**Female:** I don't know, one a week maybe.
**Jon:** Okay. What would have to happen for you to go back to using the PDA? What would be some of the things that you think it would have to

either help you with or is characteristic of the PDA or whatever in order to say-
**Female:** It would have to be something easy enough to use. Some way to carry it that would be different.
**Jon:** What about some of the characteristics or ergonomics of the machine? Was that ever an issue? You know, the way it looked, the brightness?
**Female:** No, I mean, you know, my eyes are getting older. That's one issue with a pager; I can't read my pager anymore. [Laughter.] But no, that really wasn't such an issue. It was more just having it around when I needed it.
**Jon:** Okay. So, what it actually did for you was great. Was it easy for you, you felt, when you did have a PDA? If there were a way for you to-
**Female:** It was okay.
**Jon:** It was okay. Any better than what you do currently, which is going to the PC's?
**Female:** No. 'Cause a lot of times my residents or house staff will have one.
**Jon:** Okay.
**Female:** But probably not in private practice. That's might be a little bit different.
**Jon:** So, that probably wouldn't be something that would make you go back to it, then, if they change it because it doesn't really add a whole lot of value to you right now. And then on a personal standpoint, you actually didn't even use it very much for addresses or phone numbers anyway. So, that wouldn't be something you would use it for.
**Female:** Right.
**Jon:** What about combining the phone and the PDA? I mean, you carry a phone anyway.
**Female:** Well, I leave it in my van.
**Jon:** Okay.
**Female:** 'Cause in here, you don't use it, so I don't even bring it in.
**Jon:** Okay. I'm going to delve a little bit more into when you did use it, when you did have a PDA, some of the things other than it was hard to carry. One is having the accessibility of it. If you had a PDA that you could actually find there was a decrease in the amount of time to get information or to improve what you get on a day-to-day basis with your patients, whether or not you can actually dictate into it or stuff like that. Are those some of the things that would be, from a feature standpoint, that would persuade you more to say that it's not the same because it actually does more things.
**Female:** Yes.
**Jon:** Okay.
**Female:** Give it to the hospital system so that you could easily get

your patient's information into it right away.
**Jon:** Okay. So, accessibility to information, or easy accessibility to information.
**Female:** And then you have all the HIPAA issues.
**Jon:** Right.
**Female:** That creates a huge issue.
**Jon:** Right. Okay. So, if there was a way to overcome that, whatever it is, either convince them from a security standpoint or whatever that you have access to the data so I can get it out or whatever. If they overcame that, that would actually would a positive for you.
**Female:** Yes.
**Jon:** Okay. And so when you did use it, was it confusing at all to use, or frustrating or cumbersome-any of those types of features on it? Was it easy to learn?
**Female:** Yeah, the parts that I did. It probably did a lot more than I really did, but.
**Jon:** Okay. And the parts you did was more the reference, looking up.
**Female:** Right. It did have a link. I remember one time I did check on a flight. I sat in the airport and watched my flight leave.
**Jon:** Okay. So, you actually-
**Female:** I did. Now that I remember, I had wireless, yes.
**Jon:** You did have wireless. Okay. And so you were actually paying for that, then. Someone was paying for that.
**Female:** $9 a month.
**Jon:** Okay. And that wasn't a deterrent..
**Female:** No. Though I didn't really use it often.
**Jon:** So, really, was that the only way that you used the wireless was that one time kinda looking up? Did you ever use it any other way?
**Female:** I may have looked up the news once.
**Jon:** Okay.
**Female:** But I didn't use is that much.
**Jon:** So, if you were to-If you chose to use the PDA again, do you believe that actually you'll finally use it again to do what you really want it to do?
**Female:** Yes
**Jon:** Okay. And would you say that's because of your skill level of getting things, you know, learning things quickly or being able to kind of use the technology based on your past experiences, or based on what you already did with a PDA?
**Female:** Yeah. I think most of them, they try to make them as easy as possible.
**Jon:** And so therefore, not a lot of effort?
**Female:** Yeah. You just turn it on and it should work.
**Jon:** Okay.

**Female:** Yeah
**Jon:** When you think about your patient care and kinda just go with a blank slate and just say that, you know, you know nothing about a PDA, when I first came to you and I said, I have this device and it help to assist you with patient care. What would be some of the things you would say that you would like to have?
**Female:** Billing. I hate billing.
**Jon:** Okay. What else?
**Female:** I guess writing those letters. I hate that, too.
**Jon:** And what kind of letters do you normally write?
**Female:** Just to people that have sent me patients. I'm usually behind on them.
**Jon:** Okay. So, those are the two activities that you would like to add technology to-
**Female:** Right.
**Jon:** -to really spend up or make it easier.
**Female:** Yeah.
**Jon:** I think more easy-
**Female:** I think now that you can get a lot off the computer, it's not so important having-Back in the old day when it was separate labs, having one sheet with all the labs on it made it a lot easier because you could track something. But now, the computer systems in the hospitals are to the point that you can call up the patient and you can a years' worth of labs and see the trends without having to have them handwritten into your chart.
**Jon:** Okay.
**Female:** So, that wouldn't be so important.
**Jon:** 'Cause you already have access to that as well. When you think of others that use PDA's, do you know others that use it personal-
**Female:** Well, Dr. <omitted>, she just came in. She uses a PDA.
**Jon:** Okay.
**Female:** She's always flipping it out to look for something.
**Jon:** Is that right?
**Female:** She actually, she does use it often.
**Jon:** What about personally? Do you know any friends or people that you know that personally uses it?
**Female:** I think some of them use it for information and for e-mails. Text messaging and stuff.
**Jon:** These are personal acquaintances.
**Female:** Yeah.
**Jon:** Okay. And then on a professional standpoint, other physicians or others that use it? Do they use it just for referencing or?
**Female:** Mainly for referencing.
**Jon:** If you found that the use of a PDA really increase your delivery of

quality patient care, would you use it?
**Female:** I probably would. Patient care is important to me.
**Jon:** Would it matter how easy it is to use?
**Female:** Probably not. Since I'm in this job to help patients, there are a lot of things that we do that isn't easy to do but we do it anyway.
**Jon:** So, I think that's pretty much about it. Now, based on what we talked about, anything you want to add?
**Female:** I like technology when it works.
**Jon:** When it works. Okay. That's good
**Female:** You like this brand new computer here?
**Jon:** Uh-huh.
**Female:** The guy came and set it up, said it was a beautiful computer. But it was dead. Wouldn't even boot up the first time.
**Jon:** Is that right.
**Female:** We had to get a second one.
**Jon:** So, it's frustrating.
**Female:** And it still has glitches, so. Anyway.
**Jon:** Okay.
**Female:** [Laughter.]
**Jon:** So, technology's nice. So, it's not the-
**Female:** As long as it's working it's nice. It's a lot like my car.
**Jon:** Okay.
**Female:** As long as it runs, I'm fine.
**Jon:** When you get it in and you turn the key-
**Female:** Right.
**Jon:** Okay. Well, that makes sense. [Laughter.]. So, it's not that you're afraid of technology, it's just the fact that it's the types of things and you want to make sure that they're working and if they actually add value.
**Female:** Right.
**Jon:** Okay.
**Female:** And that I don't lose it.
**Jon:** And that you don't lose it. Okay. Now, lose it being physically lose it. Like a PDA, you could-
**Female:** Right. Leave it somewhere. Or have somebody pick it up.
**Jon:** So, thefts. Anything else?
**Female:** No.
**Jon:** Okay. That's great. Pretty painless, right?
**Female:** All right. Good job.
**Jon:** Thank you very much.
[End of Recording.]

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**Jon:** We're going to record this.
**Female:** All right.
**Jon:** And it is starting. I'm going to just put it right there.
**Female:** Okay.
**Jon:** Let me tell you really quickly. I'm just looking at the use or non-use of technology and physicians. We have these models that don't seem to work in healthcare. So, I'm trying to look at it in a different way by not doing surveys and that type of thing. Looking at it more qualitatively. Talking to doctors and physicians. Talking to physicians and trying to understand, you know, do you use it, do you not use, why don't you use it if you don't, that type of thing. And so hopefully that way I can get a little bit more insight and come up with different models that work in the healthcare field. So, that's the reason for my study.
**Female:** All right.
**Jon:** So, uh, so, of course, there aren't any wrong or right answers. The more you take the better. Also, don't feel like you need to stop. Just kinda keep talking if you have more thoughts. And then at the end, I'll give a chance to kinda go back and rethink anything you said. So, I know you do the one-on-one contact with patients, of course. What other types of forms of communication do you currently use right now?
**Female:** Phone. E-mail, although the e-mail communication doesn't usually include patient advice or discussion of symptoms. Even if a student contacts me by e-mail and asks for advice or health information, I usually advise via the e-mail, you know, make an appointment with me or call me. So, rarely is that used to convey, again, for HIPAA reasons, used to convey any medical advice. But I do commit via students that way. If I can't get in touch with them by phone, I've left messages, I usually e-mail them and ask them to contact me in the clinic, or one of clinic staff will do that. Fax, I suppose. I've had a few students not communicate maybe directly with them, but communicate with other providers that they've seen and transferred information and things like that. I think that's pretty much it.
**Jon:** Okay. And so if you were to think about the percentage of time that you kinda of spend in each of these communication methods, would you say a hundred percent of the time divided by one-on-one contact, your fax, your e-mail, your phone contact, how would you kinda break that down?
**Female:** Okay. The student body as a whole or?
**Jon:** Actually, patients.
**Female:** I mean, 95% one-on-one. Of the patients I see during the day,

maybe only one or two I'll need to even follow-up via phone or have them call me back.
**Jon:** Got it.
**Female:** Now, there will be some exceptions to that, obviously. An individual student I might do more phone contact versus clinic and that might have to do with their schedule or not being able to see me or whatnot. So, okay.
[Stopped for interviewee to take phone call.]
**Jon:** Okay.
**Female:** Ninety-five one-on-one. I'd say probably 4% phone, and then split the rest up between fax and e-mail. Very little fax and e-mail.
**Jon:** And on the personal standpoint though. Well, professionally, not saying the patients, but say with other clinicians or with employees here in the medical center, or personally e-mail.
**Female:** I do, I do.
**Jon:** And how much time do you think you spend say per week or per day or whatever kinda personal.
**Female:** Okay.
**Jon:** And kinda split between how many hours a day personal, how many hours a day kinda professionally.
**Female:** I do very little personal e-mail, so I would say maybe 10% personal e-mail. The rest-I don't know if this is considered e-mail. I'm on the ACHA newsgroup.
**Jon:** Internet.
**Female:** Yeah. I'm on the ACHA, which is the American College Health Association. So, I spend maybe-I mean, I'm sure. I don't think actually-Ten percent of the day. I shouldn't say that.
**Jon:** Let's just say time wise.
**Female:** Okay. I say about maybe 15, 20 minutes personal, maybe 15 minutes ACHA. I will spend maybe 20 minutes-Yeah, I do all the arranging for in-services, so I do spend a lot of time with that. Let's say a week, maybe, two hours a week or so, two or three hours a week e-mailing. You know, it's hard to say. It's not solid e-mail time.
**Jon:** Sure, right.
**Female:** It seems like that has been the communication of choice for a lot of the professionals here. So, I'll e-mail some case information to a specialist and say, "Hey, is this something you think you might need to see?" Of course, I don't send patient names with that, but something they should see, or can you follow this person up, or hey, what do you think about this. I have done that.
**Jon:** Okay, right. Definitely.
**Female:** Now, I don't have a pager. So, anytime that somebody needs to get in touch with me, I usually-No pagers.
**Jon:** You have a cell phone, though.

**Female:** I have a cell phone, yes.
**Jon:** And do you use that personally or professionally or both?
**Female:** Only personally.
**Jon:** Okay. And because you don't actually have many emergencies because it's student health-
**Female:** I don't.
**Jon:** You're not going in the hospital and dealing with any emergency area.
**Female:** Right.
**Jon:** So, you actually have kinda confined hours that you actually are focusing on patient care.
**Female:** Yes, yes. Now, I'm on call. I'm in the call rotation. And I will have a pager that's passed around for that, but I don't have a personal pager.
**Jon:** Okay.
**Female:** And that's communication by cell phone to patients.
**Jon:** Okay. So, the patient calls.
**Female:** And call 'em back on the cell phone.
**Jon:** Okay. Now, let's kinda go back to where you were saying about the e-mails. How many do you receive professionally and personally?
**Female:** Well, I'm on the ACHA newsgroup, so I do get probably about 15 a day. And I lot of them I don't even open, I just go cancel, cancel, cancel, cancel.
**Jon:** Right.
**Female:** Probably very little personal e-mail, maybe one a day. We do communicate in our office via e-mail so we have sorta like the memos. No longer memos, it's e-mails, you know, heads up, there's a meeting on Friday, or this is the new AMA recommendations for treating something something. And so that's maybe one or two a day of those.
**Jon:** Okay.
**Female:** We communicate on personal things in the clinic, you know, so-and-so's father passed away or whatever. We do things like that.
**Jon:** Okay. And so you say you use a cell phone. It's pretty much personal.
**Female:** Yes.
**Jon:** So, you would say on average how many minutes per month do you use it? What is your bill kinda like? Minutes-wise.
**Female:** We use our cell phone quite a bit. I don't know minutes-wise. I don't know how much we have. We pay about 150 a month. Now, that also includes long distance. All our long distance is on our cell phone.
**Jon:** It is. Okay. And you don't have a plan x that include long distance, is that true?
**Female:** The plan does include long distance. We tend to go over our minutes on our cell phone. And that's what brings it up to 150.
**Jon:** And so do you have a home phone?

**Female:** Yeah, we have a landline.
**Jon:** But you kinda use the cell phone a lot more for the long distance.
**Female:** Long distance. Land line for regular home and for local.
**Jon:** Got it. Okay. Are there any other forms of technology that you think you may use that I haven't mentioned?
**Female:** Well, we have a digital camera.
**Jon:** Okay.
**Female:** And we have movie camera. I mean, it's not for work really.
**Jon:** Right, not for work, but you do use 'em personally. You know, one of the things I look at is how does your personal use of technology transfer to your professional use.
**Female:** Okay. Well, actually, we do have a camera at the other campus, a digital camera, that we can take-We've actually taken some pictures of students' rashes and things like that. Now, those can be downloaded and kept on file. I don't think we've done that yet, but we have them saved. Now, the other thing I use on the computer quite frequently is we have a link to Up-To-Date. You've probably heard of that.
**Jon:** Yeah, I have, I have.
**Female:** And that is a service that institutions or individuals sign up for. It's a very comprehensive, mainly internal medicine, database that you can look at. Current recommendations for treatment and care. And it has a lot of references. So, I use that probably as opposed to opening up a textbook. We have all textbooks. But I really depend on that probably for the majority of my resource checking. And so I'll log onto that maybe two or three times a day. Even medication dosing. I look at that. It has a pretty comprehensive list of meds and dosing and recommendations and things like that. I also use MD Consult, which is a link mostly to articles, but they have a quick kind of consult section as well. So, I do use that.
**Jon:** Okay, great. Do you use any applications online personally? Quicken, MS Word, Excel? Anything like that at all.
**Female:** All right. Let me tell you, my knowledge of computers if very limited, so all those things, I mean, I open up attachments if someone emails that. To be honest with you, I don't know the programs that are used to do what I do. I do Word. I use Word. A lot of times students will ask me to write letters to explain visits. A lot of them try to get withdrawal and things like that. Well, this is bigger. I mean, this is students that get very sick and have to withdraw a lot of the time to get refunds and things like that. So, I will write letters on Word. But I'm sure other programs are on there and if I use them with any of what I do, to be honest with you-Like Quicken. I'm not sure even what Quicken is, to be honest.
**Jon:** It's a financial software.
**Female:** Okay. No, I don't. Well, we do TurboTax. Does that use Quicken?

**Jon:** Actually, it's the same company, Intuit.
**Female:** Okay, that's right. 'Cause it has the little coupon to get Quicken.
**Jon:** Do you use it or your husband?
**Female:** My husband.
**Jon:** Okay.
**Female:** He's much more technically inclined that I am. So, he knows all of the file names and what that means.
**Jon:** Right. Got it. That's good. So, how would you define technology?
**Female:** Define technology. Boy. I guess I see technology as a new tool in sort of the world that helps us communicate and learn through methods that are probably quicker. I see it as a way to be more efficient and faster with day-to-day activities. So the phone, being able to call someone. Being able to call somebody versus having to send them a letter. So, this is technology, an advancement in sort of either communication skills or ability to obtain information. I see the Internet as this huge-But of course we're depending on these people. How do we know what they're saying is true.
**Jon:** We begin to take it for granted and we take it as true, you know.
**Female:** You do. It's scary. I go to a web site. Oh, look, hydrangeas are purple. Oh, okay.
**Jon:** Right, right. Exactly. You get so much information, that is really true. Some validation of the information, who's going get it faster and more efficient.
**Female:** Yeah.
**Jon:** So, you said quicker, more efficient, faster. What about-
**Female:** And for example, all of our bills are paid online. So, again, it's sort of, I guess, you know, made that whole process of like bill paying a lot easier and faster.
**Jon:** I was waiting for that term-ease of use.
**Female:** Ease of use. There you go. Ease of use.
**Jon:** Okay.
**Female:** Right.
**Jon:** If you couldn't find another way to do something that your PDA did the best and improved how you cared for your patients, improved the quality of patient care, would you use the PDA even it were hard to use.
**Female:** If I could do it any other way?
**Jon:** Correct.
**Female:** I would use it. I would care as much about how easy the PDA is to use if it really did help me in my practice.
**Jon:** Now, how familiar are you with the use of PDA's in the healthcare field?
**Female:** I actually got a handheld Palm Pilot when I graduated from medical school and I loved it. I loved it.

**Jon:** So, you used it.
**Female:** I used it. I downloaded Pharmacopedia software. I was an intern and I needed a lot of information. I did the five-minute consult, which is a very nice little-Then it ran out of batteries and I never recharged it. I used it about seven months and I never recharged, never got a new one. I'll tell you one thing I didn't like about it was I didn't like looking at a small screed and having the scroll through. Because I really like the idea-Even a little tiny book. When I was a resident, I had about 10 books in my pocket. And I like being able to see a full page and kind of knowing where to go. I didn't like having four or five lines and not being able to quick reference. Because I didn't know what I was really missing. If I got a one-shot look at something, I didn't know where to go. Like I was looking for treatment. Well, then I have to scroll down, is treatment in here somewhere. I didn't like that. That's probably why I didn't get the batteries.
**Jon:** Right. 'Cause after that seven months, you found that it was more cumbersome, I guess, would you say. Or what would you say would be the word?
**Female:** Cumbersome is probably a good word, although you think about "cumbersome," and it's this sleek little thing that fits in your pocket. A book certainly took a lot of space. I think mentally it was probably a little bit more-It was challenge-I don't know how to explain it. I guess I'm just not used to-Even when I look on the Internet, okay, or if I have an e-mail, I like it to fill the whole page. I like to see everything. I don't like having-
**Jon:** Tidbits here and then you're not able to kinda get them together or to see if you want to skip through or go back.
**Female:** Exactly, exactly. It's actually a little bit more work.
**Jon:** So, in other words, what you're saying is technology, it just really wasn't that easy to use.
**Female:** I don't think it was easy to use.
**Jon:** If you had that piece of technology where it was a little bit more difficult to use, however, it actually was a little bit more efficient than using other ways-in other words, the data was better. I'm not saying it is. But the data is better or it actually improves patient care based on using that technology-
**Female:** Yes, then I would use it.
**Jon:** Then you would use it.
**Female:** Yes. Up-To-Date I use all the time.
**Jon:** Because it really does help.
**Female:** It's very quick. I put in a word. You know, I put in a keyword, I put search, it brings up a lot of information. And I even get information, "Oh, I never thought about that," you know, related topics. "I never thought about that. You know, maybe I'll read this" You know,

so I think it's-I love it. I love that. And if they could do that in something I could carry around with me, I would definitely use it. Now, back to the other, I did always feel, as well, with the programs that I downloaded, I felt like they were summaries, they were tidbits. I felt like I was going to miss something. I did. I liked it for the Pharmacopedia aspect, doses, side effects, 'cause that's all I really needed to know. But I felt like it wasn't very comprehensive. Sometimes people don't want all that information, you want just the key facts, the key points. But I don't mind sitting and taking five minutes or less and reading about something. And that's what I do with the Up-To-Date or MD Consult. I may read the whole article.

**Jon:** Okay. So, I see what you're saying. You like to get all of it. Summaries-nice to have; however, you might miss something. You feel you might miss something. Well, you might, because it isn't full. I would say that there's something that you missed and it might be the something that you actually feel that you could actually use more.

**Female:** I just want to go back to the cumbersome aspect of using this screen. I mean, I think a lot of it has to do with, you know, I didn't have a computer until I was, I was probably middle of college. A friend of mine got their first DOS, is that what it is?

**Jon:** Okay. Yeah, sure, DOS. Mmm-hmm.

**Female:** To write papers on. So, that didn't even exist for me until-I mean, I was still doing applications on the typewriter. So, I still, when I look something up, I look in the index. I love having an index and looking in the index and saying, okay, what page to go to and having something alphabetized. So, I'm not so used to manipulating the screen, a small screen.

**Jon:** Sure, sure. Gotcha. Okay, well, that's good, because of kinda your past experience continues to kinda flow through.

**Female:** Right.

**Jon:** Your comfort level with that. Okay, great. Okay. We're going to skip a lot of this because this says if you're currently using a PDA. You currently don't use a PDA, so we actually get through a lot of these sheets quickly.

**Female:** Okay. I'm not using a PDA. I'm sure Dr. <Omitted>].

**Jon:** Yeah, well, he is.

**Female:** He uses one, I think. Yeah. Am I allowed to say that on-

**Jon:** Oh, sure you can, sure you can.

**Female:** Okay. And he pops it out.

**Jon:** Yeah, yeah.

**Female:** He uses it quite frequently, yeah.

**Jon:** So, you said you did use a PDA before. Now, did you use it personally at all?

**Female:** You know, I think I probably initially put some phone number sin

there, but it just never took off, never caught on. And let me tell you, I'm not one of these people that has this big, fat organizer, all my life is in this organizer, if I loose that-

**Jon:** You do have that?

**Female:** I do not.

**Jon:** You do not have that. Okay.

**Female:** So, I think that might have something to do with this PDA. Like I have papers in different places. I don't see myself as being-I've never really been this super-organized person.

**Jon:** Got it. With all the numbers and names all alphabetized-

**Female:** Yeah.

**Jon:** -and in the right book.

**Female:** I mean, I have my little phone book at home, but I don't have that central location for everything.

**Jon:** Okay. And so that being what you've always doing-

**Female:** Yeah.

**Jon:** -going to PDA that organizes that-

**Female:** Right.

**Jon:** -it just didn't seem necessary, or it didn't seem like a natural transition because-

**Female:** It just didn't-Yeah. I never caught on.

**Jon:** Okay.

**Female:** Yeah, it didn't seem very natural.

**Jon:** Now, did you sink your PDA with your PC? In other words, you know, you say you had reference information on it when you had it. Did you ever sink it to keep it up-to-date?

**Female:** My husband did.

**Jon:** So, it was synced, though,

**Female:** Uh-huh. Oh, yeah.

**Jon:** You did keep it up-to-date.

**Female:** Oh, yeah. We got downloaded updates and things like that.

**Jon:** Okay. But you were doing that.

**Female:** Uh-huh, for a few months.

**Jon:** Okay. So, you did have that. But when the battery ran out, it just went dead.

**Female:** Can you recharge 'em?

**Jon:** The batteries are-

**Female:** I thought once the batteries go, you lose everything.

**Jon:** Well, it depends on the type of PDA you had. I'm not sure of the type. There are two types. The Palm Pilot, was it a wireless Palm Pilot or was it just-Could you get to the Internet anywhere?

**Female:** I couldn't, no.

**Jon:** Okay.

**Female:** It was on of the very, very first ones that came out.

**Jon:** If it was one of the first ones, it actually had two double-A's that you could replace.
**Female:** Okay.
**Jon:** If it isn't one of those, it actually has a, you sit in your downloader-
**Female:** Yes, that's what I had.
**Jon:** -and then it charged them automatically.
**Female:** Right.
**Jon:** If it was that kind-And, of course, just like a cell phone or just like your wireless at home, I mean your telephone at home or whatever, you know, they can wear out and you have to replace the internal battery. But that doesn't usually after several months. They usually last several years, just like your cell phone battery will last quite a while. I don't know which one it was. But the batteries can be-That's why the ones they have now-So, I was saying, some of them you can actually recharge every time you download it. But if just kinda-I mean, you put it on the cradle.
**Female:** Yeah.
**Jon:** It gets the energy through-
**Female:** Yes, right.
**Jon:** -and charge it back up.
**Female:** Okay.
**Jon:** But that's because it has the internal battery on it.
**Female:** Okay.
**Jon:** If you had the two double-A's or triple-A's, I guess they used before, then you actually have to replace them. It might have been the triple-A's, 'cause they do last a long time.
**Female:** Well, I have still have it.
**Jon:** Yeah, so look and see.
**Female:** Okay.
**Jon:** Well, actually, you know, whatever that was.
**Female:** I didn't feel this big loss. I really didn't feel a big loss.
**Jon:** Right. So, let's go back. What would have kept you using it? What would have been the things that you could have been able to do? And you said a couple of things that you'd like to do. Now, would those be things that it would have had to have had in order of you to keep on using that? Because you did use it for several months. But you stopped using it because batteries went down. But what are some of the characteristics? I mean, whether or not it's environmental, the training, any changes necessary ergonomically, data?
**Female:** Again, I think going back to having everything easier for me to see. Like I said-Have you been to Up-To-Date?
**Jon:** No I have not.
**Female:** Would you like to see?

**Jon:** Sure, sure.
**Female:** Because let me show you what it is that I like. So, if I could have like a Palm that was almost like a mini laptop.
**Jon:** Got it.
**Female:** Bigger screen. A little bit, you know, something that didn't give me five lines. I don't know, maybe the screens are bigger now.
**Jon:** Not a lot bigger. You can buy 'em in different sizes.
**Female:** And I'll tell ya, I use this. So, let's say we were going to look up, you know, hypertension. Now obviously this is a huge topic. So, look at all of this hypertension. I mean, isn't that wonderful?
**Jon:** You can divide it by newborn and-
**Female:** Yeah. Border hypertension, pulmonary hypertension. Okay, what kind of hypertension do you want? Well, I probably just want hypertension. I mean, look at this. Let's go to regular hypertension. Now, it's going to give me a whole other list of things. You know, recommendations, who should be treated, indications for meds, initial evaluation-I mean, it just has a wonderful-Look at this.
**Jon:** You can always get a sort of tree, even on a Pilot, but you can't see the choices and be able to choose the right choice. You can't look at it all and say, hypertension, go down here. Now, was that a better choice than this? And you gotta scroll up and say, hold on, this one said just hypertension.
**Female:** Right. And let me show you the way it's-So, this is it. It's kinda like a book. You can scroll down and look where I want. And this is one thing I really like as well. If I want to go straight to treatment, I can go straight to treatment.
**Jon:** Oh, okay. That's very nice.
**Female:** So, I use this a lot. The other thing about this is that it is up-to-date. They frequently update these things. And you can look at the references and then you can actually, some of them, if I wanted to actually read this paper, I would take the paper, you know, it would cut-and-paste it, and I would bring it back and look it up. So, where in the past, if I had a Harrison's textbook, things are changing so much now. And so meds are changing, new meds are coming. They're not going to have the names of this new designer med, you know. If a patient comes in and says, I have a prescription for, you know, you know, Impala 5, I don't know what that is until I can look it up very quickly. The books aren't going to have it. They're not going to have it and they're not going to have the papers. It used to be we had to go to the library and pull out all the papers. And now a lot of them are online and it's wonderful. So, you can pull it up and you don't have to order it, you don't have to look through all the journals to get them. So, that, I think, I like being able to look at it like this. I like having that. Now, if they can somehow design something maybe not as small as a Palm, I

would certainly use it. We do all of our patient scheduling and coding online. Well, not online, but on the software.
**Jon:** So, that's billing part of the coding?
**Female:** Right. Now, we don't take insurance so we don't actually have to pick it, but we still code the visit. In other words, we give the visit a name, someone came in for xyz, you want to know. It's just for our statistics and things like that. Even though we don't bill the insurance companies.
**Jon:** Okay. So, that is done online. I mean, I'm getting it. Especially using the technology and tools that you use now, especially Up-To-Date or something very similar and easier to use, use a visual aspect of being able to-
**Female:** I'd like to be able to carry it around here.
**Jon:** Okay.
**Female:** But again, even if I'm in a patient room-When I'm a resident, you don't have access to an office, so it would be nice, you know, you're running around the hospital, to have something right on you to look up. But at my clinic, I don't see why. I don't want to read this in front of a patient. Let me leave the room a minute if I want to look up a drug name or something. Let me step out for a minute, you know, check some resources, which I usually do, and then I go back to my desk, which is five feet away-not five feet away. And I sit down and I may want to read all this. So, I don't know why carrying around something with me would change that. I'm still going to step out of the room. Do you see what I'm saying?
**Jon:** Got it.
**Female:** Like I'm not sure, for me, that would-I'm not sure if I would still do it. I think the graphics on those are probably pretty, you know, they pull out a phone and look at pictures. I don't know-
**Jon:** But you can probably get pictures-Well, you can do it on the Palm, too, 'cause they're color now pretty much.
**Female:** Oh, they are? Okay. Well, if you could do that.
**Jon:** You can do color, you can do a full graphic. So, the graphics, you see as well as you can on a PC.
**Female:** Can they hold as much information?
**Jon:** Quite a bit, actually. Quite a bit now. What you would probably need, I mean, there's probably plenty of room. So, storage shouldn't be an issue at all. And they've very inexpensive now, you know. Prices continue to go down on that. But there's still the other aspects that you have to kinda get into. In mean, it's not just the cost and it's not just what you can put on there. But you have to ergonomically be able to feel comfortable with it and want to use it, which is very important as well.
**Female:** I mean, and I'm a little resistant, I have to say. My husband

just got a iPod. And, you know, the iPods, you scroll through the menus and everything. I don't want to do it. You do it. Well, this is how you do it.
**Jon:** Do you feel it's cumbersome or frustrating? Or what do you think?
**Female:** I don't know. I guess-
**Jon:** Do you think it's easy to use pretty much, though? Or is it just-
**Female:** Well now I'm just starting to catch on. But I still, I still don't quite know how files work. So, many some education-
**Jon:** Okay. Some training.
**Female:** Baseline training would help the resistance a little bit. But again, if you could have a screen that I could sit and read like I'm reading a book, I'd like that. That would be much better for me.
**Jon:** Clearly, you're intelligent, so I don't think it's a training issue. I mean, you were able to pick up the PC pretty easy when you started, right?
**Female:** Yeah. Well, Windows kinds-
**Jon:** Well, that's what the-You have to-I mean, that's what a Palm is now pretty much anyways, just Windows.
**Female:** Oh, okay. Okay.
**Jon:** So, I guess it's not hard to use.
**Female:** Okay.
**Jon:** You understand the concepts and are able to use that, so.
**Female:** Yeah. Okay.
**Jon:** So, that's probably not a deterrent.
**Female:** No.
**Jon:** It would be though. Okay.
**Female:** It's just another gadget. I know you're going to hate to hear that, but I-
**Jon:** No, no. I mean, that's good.
**Female:** My husband has a heart monitor and he has a GPS and he has the little thing that-Sometimes I just, you know-Too much sometimes.
**Jon:** All right. So, do you think it could ever be a good use of, a PDA for patient care in addition to the traditional methods?
**Female:** Well, I think coding, like in private practice, to be able to code, you know, just do it right after you see a patient and even in the room, that would be very helpful. But now they're moving to get-
**Jon:** All these in the room.
**Female:** All these in the rooms. You know, as long as the information is up-to-date, you know, is updated frequently. I think drug information is very important. I think a lot of that.
**Jon:** You wouldn't look up drug information on the PC even if it were in the room with the patient.
**Female:** That I might. Drug information I might, yeah.
**Jon:** Okay. But you wouldn't look the medication for it-Would you look at

medication for a certain-
**Female:** I would probably do that research on my own.
**Jon:** On your own and come back. But that would be the same if you had a PDA, though, right?
**Female:** Exactly. That's what I'm saying, yeah. That would be the same.
**Jon:** Okay. How else do you know that uses PDA's, personally or professionally? Do you know others that use it and what do they use it for?
**Female:** Well, Dr. N. He uses it. He's frequently looking up drugs. I don't see him looking up-I think he uses it mostly for drug information. I'm not sure how much he uses it for other. I think that's all I know.
**Jon:** Really? What about personally?
**Female:** You know, now everybody has these laptops, so it feels like they use that. I think that's it. Isn't that awful.
**Jon:** No, it isn't awful. That's a good transition to that.
**Female:** Okay.
**Jon:** Talk about social norms.
**Female:** Yeah.
**Jon:** Talk about others that use it, if you see other people using it and what they use it for. Oftentimes it makes it easier for you to say, "Oh, you use it for that?"
**Female:** You might want to interview some of the residents.
**Jon:** Oh, okay. 'Cause they're using them.
**Female:** I think they're probably using them a lot.
**Jon:** Right.
**Female:** Yeah. So, that might be something to think about.
**Jon:** Absolutely. I'm pretty much finished. Is there anything you want to add or change or modify?
**Female:** I don't think so.
**Jon:** This is great. I think it's going to be helpful.
**Female:** Okay, okay. Well, I hope so. Sorry I'm one of the-
**Jon:** No.
**Female:** -non-believers.
**Jon:** No, no, no. Actually, I'm looking for those more than the believers, so I really do appreciate it.
**Female:** All right. Very good.
[End of Recording.]

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Jon Blue
Interview Audio File: DS330006

**Jon:** Let me tell you a little bit more about this study and what I'm trying to do. What I'm really doing is I'm looking at the use or non-use of technology by physicians. The information system has several models that don't seem to work in healthcare environments. So, they've been doing a lot of quantitative, just regular surveys of people in healthcare. And come to find out that one particular model, which is very, very common, technology acceptance model, does not translate to the healthcare industry. So, I'm doing a different type of study. I'm doing more of a qualitative study versus quantitative study in order to really try to ascertain use or non-use, why physicians use or do not use. I'm just using PDA's as the technology as opposed to trying to be too broad. I'm focusing in on something and that's why I'm using PDA's and asking more about that. So, a lot of times I'll give you questions that may be a little bit more thought provoking. 'Cause what I'll do is I'm using as a base quantitative questions. But I'm asking why or why not. So, that actually gives me a little bit more of a select structure and allow you to talk a little more about some of those reasons, which you can't get from survey data all the time. So, it should be pretty painless.

So, when talking about PDA's, we're talking about communication and we're talking about the use of technology and non-technology. What are some of the ways that you actually communicate with your patients, different than just the one-on-one?

**Female:** You know, encompassing technology?

**Jon:** Yeah. Well, no, anyway.

**Female:** By phone. I do a lot of follow-up calls for lab work. Particularly if something's abnormal, I always want to give 'em call. Especially if it's going to change the management. And then I send letter out, too, fairly frequently. If everything's normal, I'll usually send 'em letter. I do use email, but fairly rarely. And part of it is because the patient population here is less likely to have access to the Internet. There are a few of my patients here who prefer to use email, so I do use that a couple times. I also don't like it because I'm not always entirely sure how confidential it is. And I don't want to put anything really sensitive over it, so. If they approach me about it and say, you know, I'd prefer to do this, we can do a few exchanges. But otherwise, I try to limit that, mainly for the confidentiality.

**Jon:** Do you ever fax anything to them?

**Female:** Not quite as much. And I think part of that may also be just I'm

not sure many of them have access to a fax machine routinely. And I certainly don't have one in my house either. But if they request it, I will. A few of them do. And if they request it, I'll send it. But again, it's something I really don't do much of.

**Jon:** How would you break down your percentage of use of communicating with those patients?

**Female:** One-on-one is, obviously, the highest percentage. I guess I'd say probably 60% there with office visits, and then maybe 30% over the phone and then 10%-Well, actually, I'd probably split the last 10% between mail and then maybe like a tiny fraction of 1% the others that I mentioned.

**Jon:** The 1% percent would be like the email.

**Female:** Yeah. And I can think over only two people that I've used email. I've used it before to communicate with other physicians. But between patients, it's just been one or two people.

**Jon:** Okay, so let's look at that. Non-patient, the professional. So, with your colleagues or with lab or whoever. For a professional basis only. Now, how do you communicate normally with those folks?

**Female:** I would still say it's probably a closer split between the phone email. Probably more phone, although it's probably about a 60/40 split between.

**Jon:** So, more on the phone. What about one-on-one communication?

**Female:** With colleagues?

**Jon:** Yeah.

**Female:** I mean, with the folks here obviously. If I have like a question with a consultant, I usually don't actually meet with them. If I see 'em in the hallway, you know, and they bring something up. But usually not. Like I said, I consult with colleagues here fairly frequently about things, but that's more like, you know, between rooms.

**Jon:** Okay. And so if you were to say looking at email, about how much time per week do you think you kinda scan or email? And could you kinda say personally, professionally non-patient, and then professionally patient.

**Female:** The professionally patient one, like I said, it's really low 'cause I only have about two people who prefer to communicate that way. In terms of between colleagues, probably still not that high per week. Maybe like half hour a week or something like that by the time I actually send out the few emails and get the responses. And then personally I check it every day.

**Jon:** So, you would say an hour and a half a day?

**Female:** Maybe not that much. Maybe more like an hour.

**Jon:** Okay. And so how many do you receive and send?

**Female:** Professionally, a few from patients. And from consultants and colleagues it's probably been maybe 5 to 10 a week.

**Jon:** Okay.
**Female:** Not a lot.
**Jon:** What about personally? Do you use email personally?
**Female:** Yeah. And that's probably more frequent. I usually receive several a day from friends.
**Jon:** And what about do you actually have a personal email address as well as a professional email?
**Female:** I do, but I just don't tend to use that one. I started it up after I started here because I thought it would be nice to differentiate. But I've always just stuck with the VCU on.
**Jon:** Do you use a cell phone?
**Female:** I do use a cell phone. But not really for much.
**Jon:** Not really for much. I know you gave me the number for the telepager. So, when someone needs to get in contact with you, they use-
**Female:** Right.
**Jon:** Call the center and they'll page you.
**Female:** Exactly.
**Jon:** Seems like you have a cell phone.
**Female:** Mmm-hmm.
**Jon:** How much do you use your cell phone?
**Female:** I've never exceeded the minutes on the plan. I do some calling on it, but not a huge amount.
**Jon:** And do you receive as well?
**Female:** Mmm-hmm. And we do have a department cell phone. I don't know if this pertains at all. But when we're on call at home at nighttime, you know, patients call in with questions. We can call them back on that phone so that there's a number that comes out as "828," on their Caller ID, 'cause so many people block calls now. And I do use that on call nights, which usually is 1 to 3 nights a month. So, it's not that often.
**Jon:** Okay.
**Female:** Probably make about anywhere from 5 to 20 calls at night.
**Jon:** Okay. Now, what other forms of technology? You have a pager. Professionally pretty much you use that for, I'm assuming, right.
**Female:** Yeah.
**Jon:** You have a cell phone, which is primarily personal.
**Female:** Personal, right.
**Jon:** And what other types of technology?
**Female:** Well, I actually just use the computer in general a lot, pulling up Up-To-Date and MD Consult and pulling up studies and that kind of thing for the evidenced-based stuff. And also I do pull up some patient information on that. Not patient's personal information, but like a handout or something like that, a print off of a website for them. But that is probably what I use the most. I also check drug formularies on here, too. I actually don't have a PDA and that's the one reason that I

would primarily think about getting one is 'cause you can download all the formularies into it and then it's right there. It's sometimes difficult to actually find a way in on the website here.
**Jon:** So, the technology that you kinda use, you use a phone, you use the PC, pager. You don't have a PDA currently, right?
**Female:** No.
**Jon:** Digital camera or anything like that?
**Female:** That's on my list to buy. And I have used it before. Like I've used the departments' to take photos of things that I might present in the case, but I don't have a personal one.
**Jon:** And so from a personal standpoint, it seems like the phone is more personal and the rest of it is kind of across both.
**Female:** Mmm-hmm.
**Jon:** Great. How do you define technology?
**Female:** Any variety of item that can be used to assist in day-to-day activities.
**Jon:** When you say, "assist," what do you mean?
**Female:** I guess make it easier to obtain information. I'm thinking primarily of patient care and that kind of thing.
**Jon:** Okay. So, easy to obtain information. And so if you were to broaden that outside of patients, to say technology in general, or even from a personal standpoint, how could you broaden that?
**Female:** It does seem to facilitate getting so many things done in a more timely manner or accessing things easier. Even thinking about shopping online. Even something as simple as that.
**Jon:** Okay. How familiar are you with PDA use in healthcare?
**Female:** Fairly well. The wave sorta started when I was in medical school. And a lot of my classmates ended up purchasing them then. And I certainly thought about it. But money was the main thing. And then a lot of my colleagues use them here. They're always telling me why I should get one.
**Jon:** Okay. So, you are aware. Then what are some of the things that you know that they use 'em for? I know you mentioned a couple.
**Female:** The drug formula is the big one.
**Jon:** What are the other things that you know of? Not that you would use it, but what do you know about PDA's in the healthcare field and how they get used.
**Female:** Well, I know in a couple of the residency programs that I looked at, they are actually-like at Brown and a couple of sort of, I don't know. I don't know how to characterize them necessarily. But they were actually talking about using them as, sort of-You know, like on these computers we have them up in the wards and in here and in the patient rooms and you can pull up the system on them and get the patient data. And they were actually talking about having a handheld

model like that. But I think the biggest-They may have that by now. But the biggest drawback there was how do you keep it completely confidential. There's going to be all this patient information sort of floating around there. The other thing that is pretty useful is the programs like Epocrates and that kind of thing where you can look up so easily the drug interactions, which you can use Up-To-Date for, but it's probably a little bit easier if you just take it out. In terms of the clinical programs, I don't feel like they're any better on there instead of having them here, 'cause we do have these in all the rooms, so.

**Jon:** You have them in patient rooms as well?

**Female:** In patient rooms, yeah.

**Jon:** Okay. Which is different in some of the hospitals.

**Female:** Yeah.

**Jon:** So, you would actually look up that type of data while you were sitting there with a patient.

**Female:** Mmm-hmm. They may say, you know, what did my x-ray show and I might not have the report in front of me, which is fairly frequent here. And so instead of running out of the room, it's kinda nice to have it there. And also just to kinda pull up their lab work and be able to compare it.

**Jon:** So, just another step you have to take, but it's not a huge step to do that.

**Female:** Yeah.

**Jon:** Okay. I'm going to kind of split off now. Now that I know that you're not using a PDA, we're going to talk a little bit more about why you don't use it, what would make you use it. Like you talked about a few things, but we'll go into a little bit more detail. Have you previously used a PDA?

**Female:** I would have to say no.

**Jon:** Okay. We talked a little bit about that, but what, if anything, would make you use a PDA?

**Female:** Well, I guess part of it is the convenience. Like I said, there does seem like there's a lot of useful-like just from what I've seen here-sort of very useful programs that probably could save a great deal of time when I compare how long it takes me sometimes to find the formulary in here. So I think that would definitely help.

**Jon:** What about a personal example?

**Female:** I don't know. I don't know if I would or not. I don't think so.

**Jon:** Okay.

**Female:** Can't say never.

**Jon:** Okay. What would make you use it personally? Whenever that is. I mean, just kinda what it does today.

**Female:** If it would vacuum. [Laughter.] But otherwise, I don't know. I don't really use my home computer all that often. I'm sure there would

be something, but at this point. At this point, I definitely would not buy one for personal use, but I would very seriously think about buying one for professional use.
**Jon:** Okay. So, you admit that using one would be confusing?
**Female:** Not really. No. Like I said, I'm just fairly accustomed to, you know, I've been around computers. I think they'd be harder for people who haven't necessarily really had a lot of exposure. But no, I don't think it would be that.
**Jon:** Okay. Do you believe that it would be frustrating at all? These are kinda similar.
**Female:** At times it probably would be.
**Jon:** Okay. What are some of the things that you think would make it frustrating?
**Female:** Well, I don't know if it's still something that happens with them. But I remember in med school a lot of my colleagues had trouble with them crashing and then they couldn't get the material back. They may have improved that. That would be very frustrating.
**Jon:** And so you've basically seen the PDAs, would it be cumbersome to use.
**Female:** Doesn't seem to be. I've tinkered around with them a little bit.
**Jon:** When you say not cumbersome is it because of it's the way that-You said you've tinkered around with them.
**Female:** Yes.
**Jon:** So, they seem to be pretty straightforward or close enough to a PC, you think, that it would be an easy transition?
**Female:** I don't think it would be too difficult.
**Jon:** So, do you think it would clear and understandable to use a PDA?
**Female:** Mmm-hmm.
**Jon:** Okay. What are some of the reasons why you think that? If you compare it to other things that you've used that are kind of clear and understanding, why do you think that would.
**Female:** They seem to be fairly like self-teaching in a way. It all seems very logical, you know, the pathway that you follow to get the information you want. And I think, like I said, knowing a little bit about how systems in general work, I would think it wouldn't be too difficult. It's user-friendly anyway.
**Jon:** Okay. And so you think it would be easy for you to find the things that you need, to do what you want it to do.
**Female:** Mmm-hmm.
**Jon:** It's a easy transition to that, is what you're saying.
**Female:** Yeah.
**Jon:** Okay.
**Female:** I wouldn't think it would be incredibly difficult.
**Jon:** Wouldn't require a lot of mental effort.

**Female:** Right, right.
**Jon:** Okay. That was my question. And I think you've kinda explained the reason why. So, you think that it would be very good to use it for patient care in addition to traditional methods. What kind of value do you think it would add to that? You talked a little bit about the drug formulary and-
**Female:** And that's a huge one. And also the interaction, like I said, various interactions and that kind of thing. That would certainly help. In terms of would it be better to have patient information there as opposed to the PC in the room, I don't really see that that would-In fact, I would rather probably look it up on here. 'Cause, you know, by the time you get all the little information in there it changes. So, what else. What else. I don't know.
**Jon:** Who do you do billing now? I mean, how do you code now?
**Female:** We have just a paper sheet, the old paper format. I forgot about that. That's a really good idea. That would be excellent.
**Jon:** Send it wirelessly.
**Female:** Yeah. The ideal thing would be to have everything. But they still have paper charts here.
**Jon:** You don't do any electronic charting?
**Female:** In the hospital we do, but yeah, they're working on getting on getting it for the clinic. And that would be absolutely wonderful. Like I know the practice at St. Francis that they're just opening now 'cause one of my colleagues is going over there. And she said everything is electronic. And it's great. That would definitely-I forgot about the billing encoding. If that could be done by computer, that would be-Or if you could actually-
**Jon:** Use a PDA and then do a secure wireless into the system.
**Female:** Right.
**Jon:** Where you could do it either place.
**Female:** Right. Exactly.
**Jon:** Just bring up the number. You don't have to have the name or anything.
**Female:** Yeah. Or to look up-Another thing that it would be useful for is to have-There's a lot of diagnoses that we don't have on our paper sheet, you know, to get the code number for. That would be real helpful. And that you could probably have a program on the PDA, I would imagine. But also to be able to get sub-specialists' and consultants' records would be really helpful. You know, right now we're still sending them campus mail. Of if it's a person from another non-MCV group, it has to come in by regular mail. So, that would be real nice to have.
**Jon:** And be able to do it in a secure way of course.
**Female:** Exactly.
**Jon:** To have that and pass it back and forth.

**Female:** Right.
**Jon:** And have your patient information there and be able to access it.
**Female:** That would be huge, yeah. And it would also be nice if there was sort of a connection between all the major medical centers in Virginia, I mean in Richmond. But I don't think that that would happen. Because there are a fair number of people who go here and here and here.
**Jon:** Especially with all the clinics around, Patient First or whatever.
**Female:** Exactly. Like VA Hospital has their CPRS System and you can access any VA hospital on that. Some people may have gone to the VA in Beckley where they get their care and then come here for something. And you can actually go in and pull up all their records from Beckley by remote data system on CPRS. So, you can find-Yeah, it's really helpful. I don't know quite they didn't get that tech system over here. I don't know enough about it to say.
**Jon:** Yeah, that would be nice. Especially even within the system here.
**Female:** Yeah. Another nice thing with CPRS made me think of this. If there would be a way to do prescriptions without having to-They do have one on the system, but it's been shaky, at best, in the past. And it's hard here just because there's a pretty long list of medicines. To actually load them all in there, it does take some time. And then if you're not sure if it's going to work. But, yeah, if there were a way to do that.
**Jon:** And what is that?
**Female:** Oh, it's the computer, the para-chart. The patient's records.
**Jon:** Internally, okay.
**Female:** Yeah. Patient records.
**Jon:** Okay, great. So, prescribing or whatever would be beneficial if you ever do that.
**Jon:** Prescribing. The unload it daily, anything new. Just load it in when you sink it normally to back, you know, whatever. Update your formularies. And you can just kind go through the name. And you can also have a description on what it does and the side effects. That is available. Very few people are using it still because, you know, technology and healthcare is just not where most industries are. And that's kinda, you know, that's interesting.
**Female:** I think there's probably been some reluctance. I mean, when you think about the generational stands that are involved in healthcare. I mean, it's gotta be hard if you've never been around computers to all of a sudden-Like my dad said, "I see no reason to go from paper charts." He has a computer, but doesn't have any-
**Jon:** Okay, okay. You're absolutely right. Because, you know, the didn't really have the first IBM PC's till the early 80's and that's not but a couple years ago. And healthcare's been going on for a long time.
**Female:** I was going to say, I guess the confidentiality aspect is always

a big thing, too. You know, like how do you transmit this information.
**Jon:** One of the things I think is the education level of the industry because there are easy ways to transmit information. Think about, you know, keeping paper charts. I mean, you have so many people going in there charting and going in there. Now, even HIPAA says, you know, separate area. But, you know, you've got receptionists and clerks that have access to all that data. If it were all electronic, they could only get into it if they have a password. So, that's even more secure. But people don't think like that; they think traditionally. It's a mindset, like you said. One last major question talks about the usefulness of the technology and the ease of use of the technology. Have you found that utilizing the technology was very useful for your patient care? In other words, you were able to get the data or whatever it was. Do you think that the ease of use would make a lot of the difference in that? What do you think when you kinda weigh the two?
**Female:** You mean do I think it would help with efficiency?
**Jon:** Well, do you feel that-Would you use it if you found out that using a PDA had the right type of data and information even if it were more difficult to use it? In other words, you have actually learned a little more. I mean, just like-
**Female:** Yeah. I mean, if it overall improved efficiency I would, yeah.
**Jon:** Okay.
**Female:** You can take that initial step. I mean, it's the same thing when we got the new system here. It used to be that old HIS, I think it was. And everybody was, when I was an intern that's how it was. And there was this huge argument about, oh, it's a system we know and it's going to be-But, you know, you learn how to do it and it is so much better and so much more efficient. So yeah, I definitely would.
**Jon:** More than likely, if something was very useful for your practice in dealing with your patients and doing your charting, if it's useful, you would actually take the step to say, I don't really care if it's easy or hard-
**Female:** Right.
**Jon:** -if it's going to help, I'll go ahead and do it.
**Female:** Yeah. I mean, I'm assuming you probably like the initial step of actually learning it. Yeah, yeah. I think it takes time. And if it's going to improve, like I said, improve efficiency and improve the quality of patient care, of course.
**Jon:** Right. Okay, great. You said you know a couple of people that use a PDA that you know of.
**Female:** Mmm-hmm.
**Jon:** Professionally. First off, how do they use it and then on a personal side, do you know anyone who uses a PDA at all and how do they normally use it.

**Female:** Well, on the professional level, I think we've probably touched on most of the things that they use it for. I'm trying to think what any of them have said in terms of the personal aspect for them, if they use it for anything. I guess we really haven't talked much about that. I know people keep like their address book and phone numbers and that kind of thing. But beyond that-I'm sure they do more.

**Jon:** Okay.

**Female:** In terms if I know people personally who use it for personal use?

**Jon:** Mmm-hmm.

**Female:** Not too many, actually. Not that many.

**Jon:** So, do you think if you knew other people that used it personally and you saw them using it that that would be more inclined for you to use it personally?

**Female:** Yeah, maybe. But yeah, probably.

**Jon:** I think that's pretty much it. Now, is there anything you want to change of modify, or anything you want to add that we talked about today?

**Female:** No, not really

**Jon:** Okay. All right. I think that's probably it.

**Female:** All right, very good.

**Jon:** Do you have any questions for me?

**Female:** I don't think so.

**Jon:** Okay.

**Female:** Good luck with everything.

**Jon:** Thank you.

[End of Recording.

# Vita

Jon T. Blue was born on February 21, 1959 in Martinez, Contra Costa County, California and is an American citizen. He graduated from John F. Kennedy High School in Richmond, California in 1976. He received his Bachelor of Science in Computer Science and Mathematics from the University of California, Davis in 1981.

Jon worked for five years for the International Business Machines Corporation (IBM) in their San José, California software laboratory before receiving his Master of Business Administration from Santa Clara University in Santa Clara, California in June 1986. He continued working at IBM for an additional two years and subsequently worked at Hewlett-Packard for 12 years. His corporate career ended with two years at 3Com Corporation.

In 2002 he entered the business, information systems, doctoral program at Virginia Commonwealth University (VCU) full time. He is a KPMG Doctoral Scholar and Fellow and is a member of the Outstanding Student Society.

While matriculating at VCU, he taught Database Management and Systems Analysis and Design. He also published the following articles:

Blue, Jon T., Andoh-Baidoo, Francis K., and Sutherland, John W., *"The Use of Directive Decision Devices to Make Effective Management Decisions: Applications in the Financial Industry."* Hawai'i International Conference on System Sciences – 39, Kauai, Hawai'i, January 2006.

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